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ABSTRACT

This conference on competency based mathematics education was held in response to inquiries from mathematics teachers, curriculum directors, principals, and district administrators. Topics include: (1) What is competency based education; (2) The status of competency based education; (3) The process for developing a system of competency based education; (4) Lists of objectives and test items available for use in developing such a system; and (5) The position of various agencies with respect to competency based education. Papers that address these topics and descriptions of programs using competency based education are presented. (MP)

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REPORT ON THE CONFERENCE ON COMPETENCY BASED MATHEMATICS EDUCATION

MADISON, WISCONSIN

JANUARY 13, 1978

PREPARED BY

DONALD L. CHAMBERS
MATHEMATICS SUPERVISOR
WISCONSIN DEPARTMENT OF PUBLIC INSTRUCTION
126 LANGDON STREET, MADISON, WI 53702

Barbara S. Thompson, Ph.D., State Superintendent

Robert C. Van Raalte, Assistant Superintendent
Instructional Services Division

Arnold M. Chandler, Ph.D., Director
Bureau for Program Development

Bulletin No. 9391

SE 028 494

INTRODUCTION

The Conference on Competency Based Mathematics Education was held in response to inquiries from mathematics teachers, curriculum directors, principals and district administrators who wanted to know:

1) what is competency based education?
2) what is the status of competency based education, both nationwide and within Wisconsin?
3) what is the process for developing a system of competency based education?
4) what lists of objectives and test items are available for use in developing a system of competency based education?
5) what is the position of the various state agencies with respect to competency based education?

In order to most efficiently respond to these questions from local district personnel in all parts of the state, the Department of Public Instruction, through the Bureau for Program Development of the Division for Instructional Services, sponsored the Conference on Competency Based Mathematics Education.

The conference was announced through two communications to district administrators through the legal mailing system of this Department. In each of those letters, and at the conference itself, the neutral position of the Department of Public Instruction with respect to the issue of competency based education was explicitly indicated.

One of the important services provided by this conference is the identification of districts and personnel having experience in the planning and implementation of competency testing or competency based education programs. An exchange of information should be greatly facilitated by the inclusion of that information in this report.

This report does not describe definitively the state of competency based mathematics education in Wisconsin. It does not include descriptive materials from several of the districts which have indicated an involvement in competency testing or competency based education. If such material is subsequently received it might be possible to issue a supplementary report containing it.

It would be impossible to hold a conference of this kind without the voluntary cooperation of the persons who planned the program, made the presentations, and served as discussion group leaders. I am happy to thank the following persons for their services:

John Aceto; program committee, presentation, discussion leader

Eunice Berg; program committee, presentation, discussion leader

Arnold Chandler; presentation

Mildred Gaussman; discussion leader

Jerry Hibbard; discussion leader

David Johnson; program committee

Henry Kepner; program committee, presentation, discussion leader

Kilane Koehn; discussion leader

Courtney Leonard; program committee presentation, discussion leader

Tom Stefonek; presentation

Donald L. Chambers
Mathematics Supervisor
Department of Public Instruction

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CONFERENCE ON COMPETENCY BASED MATHEMATICS EDUCATION

January 13, 1978

8:30 - 9:00		Registration and coffee
9:00	I.	Components of a Competency Based Program Donald L. Chambers
	II.	National Developments in Competency Based Education Henry Kepner
	III.	The Racine K-12 Program John Aceto
	BREAK	
	IV.	The Shawano K-8 Program Eunice Berg
	V.	The Manitowoc 9-12 Program Courtney Leonard
12:00 - 12:45	LUNCH	
12:45	VI.	The Department of Public Instruction's Role in Competency Based Education Thomas Stefonek, Director, Bureau for Educational Planning, Evaluation, Information, and Research Arnold Chandler, Director, Bureau for Program Development
	VII.	The Wisconsin Legislature's Position on Competency Based Education Donald L. Chambers
	VIII.	Discussion Period I
	BREAK	
	IX.	Discussion Period II
	X.	Research on Competency Based Education Henry Kepner
3:30	XI.	Summary, Evaluation and Adjourn

Program Committee:

John Aceto, Racine Public Schools
Eunice Berg, Shawano Public Schools
Donald Chambers, Department of Public Instruction
David Johnson, Nicolet High School
Henry Kepner, University of Wisconsin - Milwaukee
Courtney Leonard, Manitowoc Public Schools

Components of a Competency Based Education Program

A Presentation to the Conference on
Competency Based Mathematics Education

January 1978

Donald L. Chambers

According to Tom Stefanek, Director of the Bureau for Educational Planning, Evaluation, Information, and Research of the Wisconsin Department of Public Instruction:

> Competency Based Education is an instructional philosophy and process which includes the identification of desired pupil learning outcomes, the implementation of learning activities designed to meet those outcomes, the regular and periodic assessment and evaluation of each pupil's progress in attaining desired competencies, and the provision of remedial assistance to students as needed to assure the highest possible level of attainment regarding the specified outcomes.

Discussions of competency based education are frequently complicated by failure to clarify the terminology. Stefonek has identified competency based education as "an instructional philosophy and process". This is not entirely consistent with programs of competency testing, which focus on measurement of specific student performance skills based on pencil and paper tests. These tests may be administered at only one level (terminal) or at several intermediate levels throughout a student's K-12 education. The tests are not necessarily directly related to the instructional philosophy and process.

Competency based education includes competency testing at many levels AND the utilization of instructional strategies and content tailored to students' needs as identified by the accumulated data from competency testing. The competency testing in this case is likely to include non-pencil-and-paper data acquired from daily observation of student performance in the classroom.

Some discussions differentiate between student behavorial objectives, performance objectives, and competencies, but in this discussion, they will be used as synonyms.

Why would a district initiate a program of competency based education? There are many possible reasons: 1) The teachers of a district have recognized a need for an improvement in the instructional program and have identified competency based education as appropriately meeting that need. 2) The school board or the administration has mandated competency testing or competency based education in response to criticism (from any source) of the current program. 3) The school board or the administration has mandated competency testing in response to a request for data on student performance which may have come from taxpayers, the school board, the administration, or teachers. 4) Publicity surrounding competency based education has made districts think they are not up to date unless they have such a "modern" program. 5) The legislature or the State Department of Public Instruction has mandated such programs.

A district electing a program of competency testing will have to identify grade levels for testing, student behavioral objectives for each level, appropriate testing instruments, criteria for mastery, procedures for remediation and strategies for revision of the instructional program based on the outcomes of the competency testing.

In the case of a graduation test, the level may be 9, 10, 11 or 12, with earlier testing supplying more opportunities for remediation, but less data on the students' competence at the time of graduation. Otherwise students may be tested at the end of every year, or at the beginning of every year, or regularly at intervals of two or three years, or according to some other plan.

For competency testing, the student behavioral objectives must be selected from the curriculum as taught to the students. Important objectives which were not part of the curriculum cannot be included. We cannot require a mastery of comparison shopping, for example, if this was not a part of the curriculum of every student.

Commercial testing companies are making more and more instruments available for this purpose. However, many districts are writing their own tests in order to get the best possible fit between their own local curriculum and their test.

There are many ways to establish criteria for mastery. A student may be expected to master every objective (at, for example, the 75% level), or be expected to average a certain percent over all items on all objectives, or score above a certain percentile on a norm referenced test, or achieve a score representing performance at a certain grade level on a norm referenced test. Other kinds of criteria could also be established.

Teachers, administrators, school board, and public should all be involved in the decision to institute a program of competency testing, and should all participate in the development of the program.

Students, teachers, and public must be informed in advance of levels of testing, objectives from which test items will be selected, and criteria for mastery as well as options available to students who fail to meet the criterion.

Most competency testing programs for graduation have the dual purpose of certifying that graduates have certain skills, and identifying for remediaton those students who do not.

Programs of competency based education have all the components of competency testing programs, but also a specially designed program of instruction, a skill maintenance program, a record keeping system and a teacher inservice program.

The instructional program should be designed to insure that every student shows the maximum possible achievement at every level of testing. Instead of waiting for the tests to identify weaknesses in a student's performance and administering ex post facto remediation, the teacher is constantly aware of the level of performance of every student. The teacher then provides appropriate instruction and remediation prior to the test. The tests then certify what the teachers already know.

A one-hour test cannot cover the mathematics curriculum of an entire year, much less a three-year period or a twelve-year period. Hence, it cannot measure a student's performance over the entire mathematics curriculum. Teachers, administrators, school board and public should not equate the curriculum with the list of minimal objectives which will be tested. To emphasize this point, the curriculum must be identified explicitly in terms of maximal list of objectives which no student will complete (for there would be no more curriculum for them) but which many students would nearly complete.

Furthermore, the curriculum should not be constructed according to a hierarchy which requires mastery of any one objective before proceeding to any subsequent objective. While some objectives are prerequisite to some others, no objectives are prerequisite to all others.

In a competency based program, the curriculum can be revised in the process of identifying the performance objectives since the students will be tested after instruction toward those objectives. In a competency testing program, the testing must match the curriculum. In a competency based program, the curriculum can match the test.

Competencies once achieved are not automatically retained. The curriculum must contain a built-in provision for periodic review of aspects of the curriculum which have been previously mastered. This review should be the minimal (in time) amount necessary to preserve student skills and certify continuing mastery of them.

Record keeping for competency testing is not complicated. Record keeping for a system of competency based education can be time consuming for the teacher, both in terms of recording the attainment of mastery for each objective for each student and also the time required to refer to the records in order to plan appropriate instructional activities for each student. The teacher must not be reduced to a classroom manager. Record keeping is one of the most serious obstacles to effective implementation of a program of competency based education.

The history of curriculum development efforts is filled with accounts of good planning and poor implementation. A good program cannot implement itself. People must do that. The staff must thoroughly understand what they are required to do in the implementation and more important, want to do this. This will probably require a very effective teacher inservice program unless all teachers are involved in all aspects of the planning of the program.

MINIMUM COMPETENCY TESTING

NATIONAL STATUS AND OBSERVATIONS

Henry S. Kepner, Jr.
UW-Milwaukee

At this time, there are 29 states which have legislation or Department of Public Instruction regulations on minimum competency testing. The diversity of actions is great, and an attempt to indicate direction would be premature. From the work undertaken to date, there are several observations that can be helpful in developing a program to meet community expectations and to provide assistance for students.

The competency test movement started as an urban-based questioning of the competencies of high school graduates. State action has often taken over this concern. A few states are setting minimum standards for promotion and graduation and enforcing controls on state education. A functional literacy test is being developed in Florida. Successful performance on this test will be a prerequisite for high school graduation with a regular diploma. Many districts, and some states are in the process of developing such examinations.

Some states are developing state standards, but they leave control to the local district at this time. Missouri has developed a test to be administered to all eighth grade students in 1978-79. No action is called for by the state or local district based on the results. Idaho has developed a state test for graduation. The test can be administered as a local option. However, students who pass the test, that is, only students in districts choosing the option, will receive a state seal on their diploma.

A few states have provided the local district with the option of developing a competency test. In Colorado, a district that decides to develop a competency test must follow certain procedures. The test administration must start in ninth

grade, be given at least annually, and be followed by remediation for students who fail.

California requires districts to establish standards of proficiency in the basic skills areas, including reading, writing, and computation. A test must be developed. Frequent testing must be available for those failing. Students may not receive a high school diploma after June, 1980 unless they pass the proficiency test in the district. Oregon requires local districts to adopt competency statements and performance indicators in the basic skills areas(an abiltiy to "read, listen, analyze, speak, write, and compute"). Students must show competency for graduation.

While competency testing is being mandated in some states, other states are waiting to evaluate the movement. Others have already rejected the approach as a required way to communicate with the public. North Dakota has reacted against the procedure as unnecessary in order to provide information to the community.

Much of the recent political action on competency testing has resulted from public concerns and criticisms of education. At this time, there is little evidence on the value of the minimum competency program as a solution. One observation is that strong competency programs, testing and remediation, are costly to implement and revise. Often competency testing starts without adequate thought about follow-up programs.

OBSERVATIONS

Reports from existing and developing programs provide observations for consideration. First, there is a danger in the expectation that a single list of minimum competencies can be agreed upon. In developing an appropriate list, local or state groups are encouraged to consider a set of competencies in mathematics that includes more than computational skills. Teachers, currently

in the classroom, and community members should be involved in the selection of competencies.

The establishment of tests and testing procedures should be undertaken with care. The choosing of test items and acceptable levels of performance, the planning of piloting and revising procedures, and the understanding of the strengths and limitations of criterion-referenced testing are important components in successful minimum competency testing. The opportunities for re-testing students is crucial to the issue of promotion and graduation policies.

Careful consideration must be given to the development of remediation procedures for students who do not perform at, or above, the accepted levels. Districts often find this a difficult and costly phase. However, for most students, the minimum competencies cannot become the curriculum. In relation to student performance, two major concerns must be listed. First, testing and remediation do not guarantee that student performance will improve. This must be anticipated or dissatisfaction could become even greater than it is now. Second, there is a real danger that the listing of minimum competencies could cause studnets to take less mathematics than before. A concerted promotion of the value of mathematics and its applications must be accomplished.

Competency testing and competency based education are relatively new procedures in education. Whether the concept will provide for improved student performance over a period of time is yet to be tested. A slow, easy course of action is not an unrealistic approach at this stage.

Note: Since the conference, a valuable source has become available on the issue of minimum competencies in mathematics. The February, 1978 Mathematics Teacher is completely devoted to the topic. It presents a balanced set of viewpoints and existing programs in this area.

MINIMUM COMPETENCY-BASED EDUCATION/QUALITY CONTROL:

IMPLICATIONS AND ISSUES

The idea of quality control or minimal competency-based education must relate to the:

a) establishment of standards,
b) measurement of how well the standards are being attained by students, and
c) taking of corrective action to improve performance or attainment of standards.

Assuming such a model, significant questions arise which must be resolved prior to final decision making:

1. Who should set standards? State government, local districts, both?

2. Who should measure the degree to which local districts attain standards?

3. What is the relationship of the legislature to state-adopted standards?

4. Who shall enforce the taking of corrective action to improve performance?

5. Should a certification of graduation (diploma) be based upon minimum performance for attainment of standards? Should this attainment be based on state or local school district standards?

6. What happens to a student who cannot demonstrate the competency required? Should standards and/or competencies be formulated in the basic skills or in a broad range of desirable characteristics which an "educated citizen" should possess?

7. If standards or competencies are established by the state can a local district set less or more than this standard?

8. How often and when will students be given opportunities to demonstrate attainment of desired competencies or standards?

9. Will a student graduate upon standards attainment (minimum competencies) OR must school attendance, regardless of attainment, be accompanied with a minimal time of participation?

10. How often should standards be revised or reevaluated as to the appropriateness of minimum competency? Should there be a graduated scale of minimum competencies so persons endowed with less ability to attain knowledge and skill be allowed to matriculate through the system with approval on less than a full minimum competency endorsement?

11. Who develops the instructional-curricular modules to attain specific competencies?

12. At what grades will minimum competencies be established?

13. Will the state monitor mimimum competencies instruction in school districts?

Four additional CRITICAL issues center on:

1. state financial aids,

2. teacher evaluations,

3. administrator evaluations, and

4. the curriculum.

Division of Instructional Services
Racine Unified School District
Racine, Wisconsin

The Standards Program

Report and Recommendations to the Board of Education Curriculum Committee - January 31, 1978

Introduction

On May 10, 1976, the Board of Education passed a motion which established a standard for district pupils (see below). The motion addressed a standard tied to test results in reading, language arts, and mathematics for students entering seventh grade, tenth grade and graduation from high school.

The motion was referred to an Ad Hoc Committee of the Board of Education and shortly after, the administration formed the Advisory Committee on Standards with administrator, teacher and parent members. The task of these committees was to formulate recommendations to the Board of Education for implementation of a Standards Program.

The Board's motion addressed a growing conviction by the public that school academic standards were dropping; that social promotion was prevalent; grade inflation was the norm; and that the high school diploma is losing its meaning. National trends also indicate that state legislatures are in the process of imposing competencies and standards. Before standards are imposed from above the Racine District should be establishing locally determined standards and a viable program to meet the standards.

The recommendations of the Committees were guided by the following rationale: "A good education is imperative for all individuals in our society."

a. A good education results from a "building-block" process where each block must be sound.

b. Periodic assessment is necessary so no necessary concepts and skills remain unlearned.

c. If satisfactory progress is not made, alternatives to achievement must be provided.

The Committee's recommendations centered around three main themes: The establishment of grade level standards in Reading, Language Arts, and Mathematics; graduation requirements; and intervention programs for those students who need additional assistance to meet the standards.

Board of Education motion that was referred to the Ad Hoc (Standards) Committee

Rev. Stanton moved, Mr. Zach seconded, that:

a. Students entering seventh grade must have at least an equivalent of the 25th percentile of the 6th grade as measured by the Metropolitan Achievement Test currently being used by our district in reading, mathematics and language skills to enter junior high school. Note: This would not apply to Special Education students whose needs should be dealt with under another policy.

b. Students entering 10th grade must have at least an equivalent of the 25th percentile of the 9th grade as measured by the Comprehensive Test of Basic Skills used by the Wisconsin State Assessment Program in reading, mathematics and language skills to enter senior high school.

c. Students to be eligible for a high school diploma must demonstrate at least an equivalent of the 25th percentile of the 12th grade equivalency as measured by the Comprehensive Test of Basic Skills and/or the Madden-Peak Test of mathematics skills in reading, mathematics and language skills in order to be awarded a high school diploma. These equivalencies would be in addition to the other requirements now necessary if a student is to be awarded a high school diploma. Students failing to meet these standards and not wishing to remain in school long enough to test out on these standards could be awarded a Certificate of Attendance at High School, but not a High School Diploma.

The Standards Program - Summer, 1977, 1977-1978

The program adopted by the Board of Education for the summer of 1977 and academic year 1977-78 is described below:

Summer, 1977

Elementary: Three sites - Giese, Dr. Jones and Hansche

Three teachers and a social worker-counselor addressed the identified needs in Basic Skills of about ninety pupils. The program concentrated on academic needs of pupils but also had a strong parent component which involved mothers and fathers in their children's learning through meetings and home visits.

Junior High: One site - Jerstad-Agerholm Junior High

For those pupils who did not meet criteria at the sixth grade level and some grade 7 pupils whose needs were identified, three teachers and a counselor dealt with Basic Skills needs of the population as well as orienting pupils to the junior high school. Parents were also involved at this level.

School Year, 1977-78

Pre-First: Four sites - Janes, Lincoln, Fratt, Schulte

This full-day program is designed to assist children who would not be successful in regular first grade classes. The majority of these children would

have been retained in kindergarten - a half-day repeat of readiness skills. The Pre-First program is basic skills-oriented in which reading, language arts and mathematics skills are developed. With a pupil-teacher ratio of about 15 to 1, teachers attempt to keep close contact with the home. At the completion of the year a child may be advanced to regular first grade or regular second grade. At this point, these pupils are closely observed for possible referral to compensatory programs or special education.

Basic Skills Program - Intermediate: Three sites - Giese, Dr. Jones and Hansche

This compensatory program in reading, language arts, and mathematics offers identified students additional assistance in these academic areas. At each site, one teacher and one aide are responsible for forty-five pupils. Thirty pupils from grades 4, 5, and 6 are given services daily in those identified areas of need during the time scheduled for science, social studies, and health education with supplementary services given to an additional fifteen pupils. These children continue to participate in their regular reading, language arts, and mathematics classes. The Standards teachers, principals, and social worker/counselors continue to involve parents in the program.

Basic Skills Program - Junior High School: One site, Jerstad-Agerholm Junior

With a staff of two teacher equivalents, a mathematics teacher, language arts teacher, and a reading teacher devote part of their teaching schedule to service about ninety students in their areas of identified needs. The reading program continues the student's sequential reading development on an every-other-day basis for a class period and alternating days during the homeroom time. Math assistance is given during the regular math classes. Standards students are scheduled into classes to correspond to the Standards teacher's schedule. For those pupils whose needs are identified in the language arts area extra assistance is given by taking students from those classes on a scheduled basis. Contact is maintained with the home.

Teacher-Sponsor Program: Two sites - Case, Horlick
Unified Period Program - Horlick

The teacher-sponsor program involves identified students and their teacher-sponsors in which teachers counsel with their students and follow-up on their progress. The teachers contact the student's academic instructors to check on progress and attendance.

The Unified Period program operating at Horlick is dealing with the identified population in the language arts area and working on survival skills as language arts objectives are achieved. The teacher who has this program is an outstanding individual who has empathy with the problems and difficulties of students.

Competencies and Tests

To this point competencies have been identified in reading, language arts, and mathematics for grades K, 3, and 6. Tests are being developed and will be piloted in the spring, 1978. The Linguistics Test and the Composition Test is now operational for grades 9 and 11.

Recommendations

The recommendations that follow reflect expansion of the Standards Program which addresses the Board of Education motion of May 10, 1976. An intervention program is essential for pupils who do not meet the standards set by the district if retention is a likely consequence of falling below the established levels. The recommendations include programs for the summer of 1978, the academic school year of 1978-79, competency test development, and graduation requirements. Also included in these recommendations are criteria for selection of pupils for the program and a delineation of parent responsibility. Among the attachments is "Standards Project - Tentative Projection, 1977-1981" which indicates long-range projections for this program. The Board of Education in its commitment to the Standards Program has to recognize that it is a long term effort to provide added assistance to aid pupils in reaching their potential. For those pupils who are having difficulty intervention should begin as early as possible. The Pre-First classes have the potential of creating the necessary background for pupils to progress through the sequential program, but pupils who are in need of assistance to meet the set standards should be given the opportunity at whatever grade level they may be. Paramount throughout the Standards program is the parents' responsibility to cooperate with the school and the school to communicate with the home.

Elementary Level

Present Grade 3, 4, and 5.

Summer, 1978 - Six-week summer sessions at nine sites in basic skills of reading, language arts, and mathematics for pupils who are presently in grades 3, 4, and 5. The program will be limited to those pupils who attend school at the site. Transportation will be provided for those pupils who live two miles or more from the school.

Anticipated numbers - Approximately 30 pupils per site. Pupil-teacher ratio would be no greater than 15-1.

Staff - 9 teachers, 3 social worker-counselors, 9 instructional aides.

1978-79 School Year - Implement Basic Skills Classes and Supplementary Services for pupils moving into grades 4, 5, and 6 at the same sites as the summer session.

Anticipated Numbers - 45 pupils per site; 30 pupils in Basic Skills Classes and 15 children receiving Supplementary Services.

Staff - Nine teachers and nine instructional aides.

Present Kindergarten

1978-79 School Year - Pre-First Grade Program
A Pre-First grade program to be conducted at six sites. Transportation will be provided for those pupils who live two or more miles from the site.

Anticipated Numbers - 15 pupils per site.

Staff - 6 teachers

Junior High Level

Present Grade 6

Summer, 1978 - Six-week summer session at six sites in reading, language arts, and mathematics. The program will be limited to those pupils who will attend at the site during the 1978-79 school year. Transportation will be provided for those pupils who live two or more miles from the school.

Anticipated Numbers - Approximately 90 pupil per site would qualify. Pupil-teacher ratio would be no greater than 15-1.

Staff - 18 teachers and 3 counselors.

1978-79 School Year - Implement reading program and mathematics and language arts intervention program. The mathematics and language arts program will be implemented to closely resemble the program piloted at Jerstad-Agerholm Junior High School in 1977-78. The reading program will be implemented as outlined by the district's reading department. Reading instruction will have two phases: Developmental Reading and Remedial Reading.

Anticipated Numbers - Language, Math Programs, Grade 7, 340 pupils. Reading Program - Remedial and Developmental, Grades 7, 8, and 9 - 1067 pupils.

Staff - Math and Language Arts - 8.4 teacher equivalents; Reading - 10.2 teachers.

Senior High Level

Present Grade 9

Summer, 1978 - Six-week summer session at three sites in reading, language arts, and mathematics together with an orientation program to facilitate matriculation into the high school. Transportation will be provided for those students who live two miles or more from school.

Anticipated Numbers - Approximately two hundred seventy students would qualify.

Staff - 9 teachers and 3 counselors

1978-79 School Year

1. Continue the SPAR Program at Park High School with 120 students and present staff.

2. Implement a modified SPAR Program for grade 10 students at Case and Horlick High School

   Anticipated Numbers - Approximately 240 students.

   Staff - 5.6 teachers (equivalent)

3. Continue administering the Reading/Language Arts Competency Test to grade 11 students.

4. Implement the Teacher Sponsor Program for grades 11, 12 in three sites.

   Anticipated Numbers - 540 students for three sites.

   Staff - 2.4 teachers (equivalent) for three sites.

5. Validate Government Competency Test for grade 11 and prepare grade 12 remedial course for those pupils not meeting criteria.

Graduation Requirements

The debate continues among school personnel whether the graduation from high school for those students who achieve seventeen credits but do not pass all competency tests be issued a certificate or a diploma with endorsements of competencies passed. The question centers around whether the school district should serve as a screen for prospective employers when candidates for a job appear, some having diplomas and others having certificates. Another concern is one of motivation for students to remain in school if they lack the ability to pass all competency requirements.

Recommendation: For the class of 1980 - If present graduation requirements are met high school students will be graduated with a diploma or certificate (?) or be denied graduation as follows:

1. Passes the mathematics competency test - diploma
2. Fails the mathematics competency test and passes the Refresher Mathematics course - certificate (?)
3. Fails the test and the course - graduation denied

(Special Education students are exempted from the competency requirement.)

For the class of 1981 and classes thereafter will be required to pass the competency tests in mathematics, reading, English Skills and Government and fulfill the present graduation requirements to be awarded graduation with a diploma.

If present graduation requirements are met high school students will be graduated with a diploma or a certificate (?) or will be denied graduation as follows:

1. Passes all competency tests - diploma
2. Fails one or more competency test(s) and passes appropriate required remedial course(s) - certificate (?)
3. Fails one or more competency test(s) and fails the appropriate remedial course(s) - graduation denied

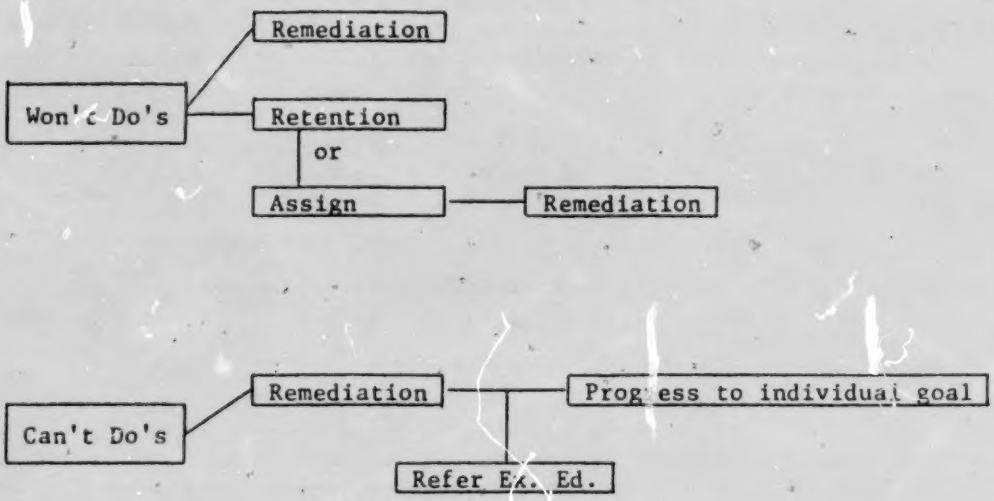
(Special Education students are exempted from the competency requirement. The type of graduation for Special Education students will be determined at a future time.)

It must be emphasized that a student will have opportunities to pass the competency tests up to and including grade 11, during remedial courses at grade 12 and would be encouraged to return after graduation to take the competency tests. A certificate could be converted to a diploma at the time when all competency tests are passed.

Can't Do vs. Won't Do

A concern has continually been expressed about the populations of "can't do's" and "won't do's" in the Standards Program. The "can't do's" comprise that segment of the population who try but are unable to achieve the levels specified; the "won't do's" are those who have the ability but do not try. Programming for these two groups probably should be different with retention seriously considered for the "won'ts" and continuous progress goal setting for the "can'ts."

Possible Flow Chart



SHAWANO-GRESHAM SCHOOL DISTRICT MATH PROGRAM

I. Development of individualized program
   A. [illegible] directive
   B. Curriculum development
      1. Developed objectives K-8
      2. Inventoried materials in the district
      3. Teacher workshops developed:
         a. individual learning packets for each objective
         b. a criterion test for each objective
         c. general criterion/assessment tests for spring and fall evaluations
         d. supplemental and alternate activities
      4. Use Iowa Test of Basic Skills for achievement testing
      5. In process of developing computer-assisted testing

II. Teacher education
   A. In-service meetings with all teachers
   B. Principals and coordinator assist with specific problems
   C. Meet with small groups of teachers on suggestions for changes or corrections of materials
   D. "Make-it, Take-it" Days for materials development

III. Materials
   A. Production by high school lithography department (summer)
   B. Storage and inventory at the district processing center
   C. Inter-library cooperation

IV. Specific characteristics of program
   A. Mastery before proceeding with new concepts
   B. Make use of alternate approaches and media
   C. Encourage use of large group, small group, and individual activities
   D. Stress use of retention type of activities
   E. Permanent folders keep record of achievement
   F. Report cards reflect individualized program

V. Advantages
   A. We know the skills our students have mastered
   B. Our students know the skills they have mastered
   C. Lack of pressure to compete outside your small group
   D. Students learn to set long and short term goals

VI. Disadvantages
   A. Students can waste time
   B. Needs of specific types of students may be neglected
   C. Not all teachers can effectively handle the program

VII. Re-evaluation of program
   A. Delete and add objectives
   B. Develop more readiness, retention, and alternate activities or media
   C. Improve our delivery systems
   D. Improve record and reporting systems
   E. Refining our testing program to make use of our computer
   F. Working toward a math proficiency test at the junior level in high school
   G. Planning ways and means of helping students who show deficiencies of basic skills on proficiency tests

MANITOWOC MATHEMATICS COMPETENCE EXAM

Is a graduate of our high school prepared to apply basic mathematics to the problems encountered in the home, in banking and financial transactions, transportation, hobbies and similar everyday situations? We have assumed that our former requirement of at least a year of mathematics beyond the eighth grade provided one with the necessary skills to meet such needs. However, assessment programs in recent years indicate that many people have not acquired or retained sufficient proficiency in basic skills.

We did not have evidence that gave us an accurate picture of how Manitowoc citizens compared to the people tested in the assessments that were mentioned above so we have initiated a two-fold program which will provide us with information about mathematical proficiency and which changes the graduation requirement from satisfying a credit in math to demonstrating competence just prior to graduation.

We began the work of determining the skills and abilities we should expect of any graduate of a comprehensive public high school such as ours, and of the best methods to evaluate their achievement.

Our own compilation of objectives was compared with studies done by the Wisconsin Department of Public Instruction, the National Council of Teachers of Mathematics, a very competent study done by the Madison, Wisconsin schools and lists of objectives for commercially available tests of proficiency in mathematics. We also requested and received input from the business community and other citizens.

The local Board of Education adopted a new high school graduation policy in January 1976 which incorporated the mathematics competence requirement to be effective for graduates of 1979.

The first draft of a test to measure our objectives was constructed during the summer of 1976 and was field tested with a group of 150 juniors who had been randomly selected from a junior class of 576.

This test, given in January 1977, consisted of 94 items in a two part exam. Part I contained 64 items designed to measure basic skills given specific directions; Part II has 30 problems to measure ability to apply skills, concepts and problem solving techniques.

The 150 randomly selected students were classified, according to preparation in mathematics, as follows:

A) 74 who were not currently in any math class
B) 36 who were in a math course below advanced algebra
C) 40 enrolled in Math III (2nd year algebra and trigonometry)

Some of the statistics obtained from this field test are listed below.

	Part I (64 items)			Part II (30 items)		
	Median	Mean	Stand. Dev.	Median	Mean	Stand. Dev.
Group A (74)	43			18		
Group B (36)	47			19		
Group C (40)	61			26		
Total (150)		47.5	11.88		19.9	5.37

The Pearson Product Moment statistic, calculated on the Part I correlation to Part II, was found to be 0.77.

In addition to these data, we compiled an item analysis to give us some evidence of the strengths and weaknesses and types of errors being made.

Although we felt that completion type items would be better measures of proficiency in basic skills than multiple choice items, and that observations of people solving problems is certainly more valid than any test situation, we were not prepared to implement that kind of proficiency evaluation program to relatively large numbers of students with any assurance of consistent methods or standards. We decided that multiple choice items using five choices per question would eliminate success by guessing, and including a "none of the above" response for those items where exactly one right answer is to be calculated should be more life-like as a problem setting then always having the right answer in a list of choices.

Those questions in which interpretations of a graph or other visual aid might vary, or where failure to recognize equivalent forms of the answer may prompt students to select a "none" response were identified and written without that response as one of the five choices.

Utilizing the item analysis and other statistics above, a revised test with 60 items in Part I and 30 in Part II was prepared in the summer of 1977 and will be administered to the class of 1979 in the middle of their junior year. This will give those students who do not demonstrate minimum proficiency as much as three semesters to review and refresh their memories or remediate deficiencies. If they have not done so by the end of the junior year they will be enrolled in a semester of refresher mathematics during the senior year and will be tested again at the end of that refresher course using an equivalent form of the competence exam.

The next steps in the competency based program include:

1) Preparation of a test and revisions in the curriculum for junior high which will be designed to publicize the competency objectives to students and parents and to identify weaknesses and correct them over the six year period rather than the three semesters following the required exam for graduation.
2) Providing activities for regular maintenance of basic skills in all math courses.
3) Planning a program of periodic review of our objectives and related tests to keep them closely related to the needs of our students, keeping alert to the impact of such technological changes as the inexpensive electronic calculator, the computer, etc. and the social and economic changes which put new demands upon us in preparing students to live in such a world.

OBJECTIVES AND SAMPLE PROBLEMS FOR

MINIMUM MATHEMATICS COMPETENCE

Manitowoc students must demonstrate that they can perform basic arithmetic computation with whole numbers, decimals and fractions, convert fractions to decimals, decimals to per cents, recognize simple geometric figures, basic symbols such as exponents or line-segment notation, and common vocabulary terms such as discount, perimeter, etc. and solve simple per cent and proportion exercises. They must also show that they can apply their understanding of these basic tools to solve problems.

Achievement of the following objectives will be measured by a two part exam given at the end of the first semester of the junior year.

The objectives of Part I are as follows:

1. The student will be able to:
   a) add whole numbers
   b) subtract whole numbers
   c) multiply whole numbers
   d) divide whole numbers

2. The student will be able to identify place values in decimals and whole numbers.

3. The student will be able to round off a decimal or whole number given the place value.

4. The student will be able to recognize equivalent expressions for numbers written in symbols and words.

5. The student will be able to:
   a) add decimals
   b) subtract decimals
   c) multiply decimals
   d) divide decimals

6. The student will be able to:
   a) add fractions and mixed numbers
   b) subtract fractions and mixed numbers
   c) multiply fractions and mixed numbers
   d) divide fractions and mixed numbers

7. The student will be able to find a fraction equivalent to a given fraction.

8. The student will be able to solve for a missing term in a proportion.

9. The student will be able to convert:
   a) fractions to decimals
   b) decimals to fractions
   c) decimals to per cent
   d) per cent to decimals

10. The student will be able to solve per cent problems in the form of:
    a) find X% of Y
    b) X is what % of Y?

11. The student will be able to calculate the average of a given set of numbers.

12. The student will be able to calculate the power of a number given the problem in words or exponential notation.

13. Geometry:
    a) The student will be able to:
        1) identify common plane geometric figures such as circle, rectangle, square, and triangle
        2) identify common 3-dimensional geometric objects such as cone, cube, cylinder, pyramid, and sphere
        3) identify relationships of lines such as parallel, perpendicular, and meeting at a 90° angle
        4) calculate the perimeter of a rectangle given its dimensions
        5) calculate the area of a rectangle given its dimensions
        6) calculate the colume of a rectangular solid given its dimensions.

14. The student will be able to solve for the remaining variable given a common formula and values for the other variables.

Sample exercises corresponding to selected objectives for Part I are shown below:

(objective 3)

Round off to the nearest 100: 6,789

A. 6,000
B. 6,700
C. 6,790
D. 6,800
E. 7,000

(objective 4)

1,200,000 is the same as:

A. .12 million
B. 1.2 million
C. 12 million
D. 120 million
E. 1,200 million

OBJECTIVES AND SAMPLE PROBLEMS FOR MINIMUM MATHEMATICS COMPETENCE

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3. The student will be able to round off a decimal or whole number given the place value.

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   c) multiply fractions and mixed numbers
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    b) X is what % of Y?

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    The student will be able to:
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    .2) identify common 3-dimensional geometric objects such as cone, cube, cylinder, pyramid, and sphere
    .3) identify relationships of lines such as parallel, perpendicular, and meeting at a 90^{0} angle
    .4) calculate the perimeter of a rectangle given its dimensions
    .5) calculate the area of a rectangle given its dimensions
    .6) calculate the volume of a rectangular solid given its dimensions

14. The student will be able to solve for the remaining variable given a common formula and values for the other variables.

Sample exercises corresponding to selected objectives for Part I are shown below:

(objective 3)	(objective 4)
Round off to the nearest 100: 6,789.	1,200,000 is the same as:
A. 6,000 B. 6,700 C. 6,790 D. 6,800 E. 7,000	A. .12 million B. 1.2 million C. 12 million D. 120 million E. 1,200 million

(objective 5b)

Subtract:

98.7 - 1.23

A. 8.64
B. 86.4
C. 97.57
D. 98.47
E. none of the above

(objective 6d)

Divide:

2 1/3 ÷ 2

A. 1 1/3
B. 1 1/6
C. 2 1/6
D. 6/7
E. none of the above

(objective 8)

Solve for x:

$\frac{5}{8} = \frac{x}{10}$

A. 5.8
B. 6
C. 6.25
D. 7
E. none of the above

(objective 9d)

Find a decimal equal to:

3.5%

A. .035
B. .35
C. 3.5
D. 35
E. 350

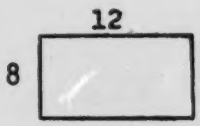
(objective 10b)

18 is what % of 90?

A. 2%
B. 18%
C. 20%
D. 28%
E. none of the above

(objective 13.5)

Find the area of the rectangle:



A. 20
B. 36
C. 40
D. 96
E. none of the above

MATH PROFICIENCY OBJECTIVE - PART II

The student will be able to function in problem solving situations with life-like settings. The operations to be used will not be dictated to the student by the format of the questions.

The problems will require a cross section of those skills covered in Part I of the examination. In addition to those skills, the student will be able to:

1. Make decisions which involve:
   a) determining the needed information
   b) selecting the appropriate operations and performing them in the correct order
   c) using relevant mathematical concepts, definitions, symbols and relationships
   d) the application of common units of measure, and their multiples or subdivisions
   e) following a set of directions or flow-chart

2. Using graphs, tables, measurement devices, diagrams, maps, etc., the student will be able to:
   a) read and obtain specific information
   b) interpolate between or extrapolate beyond the given information

Problems illustrating those in Part II in which we often have several objectives incorporated in a problem are shown below:

Your take home pay is $512.36 per month. Your fixed monthly payments include:

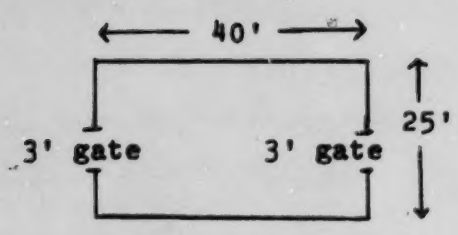
Rent: $165.00
Car payment: $93.80

How much money remains after paying these bills?

A. $253.56
B. $258.80
C. $441.16
D. $771.16
E. none of the above

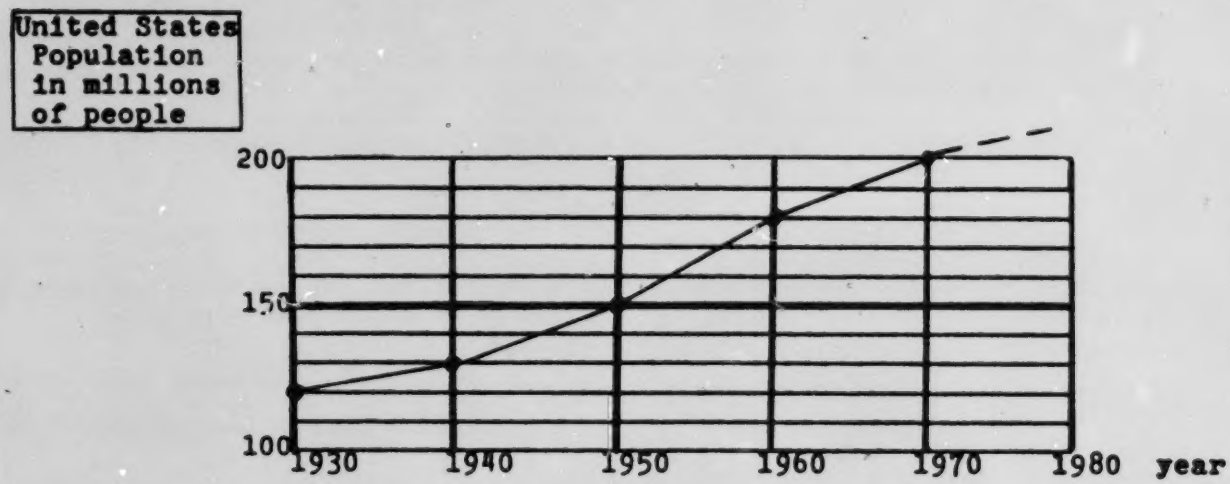
You buy a used car for $1350. If you must pay a 4% sales tax, what is the total amount you must pay?

A. $1354
B. $1383.75
C. $1404
D. $1687.50
E. none of the above



A 40' X 25' rectangular garden is to be enclosed by a fence. Fence is not needed for two 3' gates. How much fencing must be purchased?

A. 59 ft.
B. 62 ft.
C. 880 ft.
D. 994 ft.
E. none of the above



The population in 1965 was:

A. 154,000,000
B. 180,000,005
C. 185,000,000
D. 190,000,000
E. 199,000,000

Use the same graph above. Given that the 1970 population of California was about 18 million; this was what per cent of the total United States population?

A. .36%
B. 9%
C. 11 1/9%
D. 18%
E. 36%

If minimum competence is not achieved on this exam, the student has the second semester of the junior year to review in any manner that he selects. A re-test will be scheduled at the end of the year. If the student fails again, he must enroll in a semester of refresher math during the senior year and pass a final exam which will be equivalent to the required competence exam in order to qualify for graduation.

CLASS OF 1979 MATHEMATICS PROFICIENCY REPORT

January 10, 1978

The Math Proficiency Exam is a set of two tests; Part I covers 60 items of basic skills and Part II contains 30 problems designed to measure a student's ability to apply skills to realistic problem situations.

We have established the following standards of minimum proficiency:

Satisfactory performance is set at 45 or more on Part I (75%) and 18 or more on Part II (60%).

We will accept slightly lower conditional grades on one test as long as the other test is at least up to the satisfactory standard given above.

A conditional grade of at least 50% on Part II, paried with a satisfactory (75%) on Part I, or a conditional grade of 60% on Part I with a satisfactory on Part II would constitute minimum proficiency for the graduation requirement.

Our reasons for including conditional zones of proficiency are as follows:

1. We recognize that anyone may have an off day when asked to perform accurately in a test situation.
2. We realize that some people have more difficulty than others with interpretation of problem descriptions but may do well in computation, while others do well in organizing and solving a meaningful problem but seem more prone to the computation errors we all make at times, even when we know better.
3. We have constructed the tests with as much care and expertise as we could. We sought input from a broad spectrum of resource people. We are, however, fully aware of the fact that we have not had 100% agreement about all of the objectives being tested nor about the types of application problems selected. Practical considerations of test administration time and supervision precluded the design of a test of the most valid kind in which each of our students would be observed doing real tasks using mathematics and measurement skills to solve real problems. Consequently, we cannot incontestably state that these are the exact objectives one must achieve in order to function as a citizen in

this day and age; but we have constructed what we believe to be a fair test of a reasonable set of objectives.

Here are the results of our test given to juniors of the class of 1979.

We gave exemptions to 156 who are enrolled in Advanced Math and had satisfactory grades at the end of the first quarter. This was based upon the results of our field test a year ago at which time all Math 3 students met the standards we have adopted.

Three hundred and six juniors who took the test met the requirements. The 146 who failed, approximately 23% of the class, will have a second chance with a similar test at the end of this school year. Those who still fall below standard will be required to enroll in a semester of refresher math during the senior year before receiving a third form of the test.

Just as we had found during the field test last year, more students failed to meet the 75% on Part I than failed the 60% level on Part II. One hundred ninety-six students were below the satisfactory level of 45 or more on the 60 questions on Part I; 144 fell below the satisfactory level on Part II.

Using the conditional scores paired with a satisfactory grade resulted in an additional 71 people meeting the minimum requirement. (If that number had been added to the failures, it would raise the statistic to about 35% of the class failing to qualify.)

The median score for all students on Part I was 45, the mean score was 42. On Part II, the median was 20 and the mean was 19.

Our goal at this point is to bring the skills of those who failed the first round to an acceptable level before the end of their senior year.

Our long-term goal is to make whatever changes we find necessary to have an even higher proportion of succeeding classes better prepared in the basics of computation and problem solving.

A SUMMARY OF THE CURRENT STATUS OF COMPETENCY BASED MATHEMATICS EDUCATION IN WISCONSIN

Two hundred sixty-eight persons representing one hundred thirty-four districts registered for this conference. The status of those districts is as follows:

implementing a competency based mathematics program	15
planning to implement a competency based program	46
not planning to implement a competency based program	60
no information was provided	44

The total of the four categories is not one hundred thirty-four because many districts had more than one representative and the data received was not always consistent. This is not surprising since "competency based mathematics education" was not defined on the questionnaire. Furthermore, an elementary teacher might be unaware that a committee at the high school is preparing a graduation test.

Persons interested in learning about existing programs are encouraged to contact those persons who indicated that their districts are implementing or planning to implement a program in competency based mathematics education. A list of all registrants from districts planning or implementing competency testing programs or competency based programs follows. The names are arranged alphabetically by school district.

CURRENTLY IMPLEMENTING A PROGRAM

District	Representative
Antigo	Ray Blaskey
Arkansaw	Roland Donahue
CESA #6	Roland Hicks
DePere	Paul Shasta Clayton Smits
Dodgeville	Rick Hugill Dennis Polglaze
Green Bay	Reynold Swanson
Manitowoc	Courtney Leonard Howard Wilsmann
Neenah	Armand Linzmeyer
Nicolet	Lilane Koehn
Plymouth	Mildred Gausman
Racine	John Aceto Ken Rosenthal
Shawano-Gresham	Eunice Berg
Sparta	Roger Bare
Stevens Point	Emery Babcock Katie Hetzer
Tomah	Tony Evers Jerry Hibbard

PLANNING TO IMPLEMENT A PROGRAM

District	Representative
Ashland	Donald Eglseder
Baraboo	Marty Shun
Barneveld	David Jewell Patricia Reisdorf
Blackhawk	Robert Beaver
Boscobel	Don Graham
Cashton	Judith Mitchell
Cedarburg	Herman Buechel Robert Gilpatrick Greg McElwee
Chilton	Dale Voskuil
Clinton	Robert Warn
Cudahy	Gerald Benka Joseph Buichl Larry Zibell
Delavan	Douglas Kahl Owen Moyer Richard Pierson
Denmark	Charles Hillman LeRoy Meles Ray Schauer
Fond du Lac	Pat Lautenschlager
Fox Point, Bayside	Marshall Wagner
Green Bay	Douglas Page Alma Ward
Greenwood	Leneil Meyers Cliff Simonsen
Hortonville	Gene Conger Gene Riedl
Johnson Creek	Robert Ketelhohn
LaCrosse	Kathryn Cappelen Ray Sauer Jerry Weiser

District	Representative
Lake Mills	R. G. Ames Mile Fifrick Gene Thomas
McFarland	John Legler Thomas Stroik
Medford	Robert Retzer
Melrose	Don Frisby
Menasha	Raymond Feit William Herziger William VanLanen
Menomonee Falls	Paul Bioknel
Menomonie	LeRoy McGary
Merton	Donald Tuler
Milton	Elaine McGregor Tom Kemppainen Marle Newman
Montello	Wayne Schrab
Nashotah	Bernard Stankewicz
New Berlin	Gordon Hennum
Oconomowoc	John Koehn Ron Lange
Pardeeville	Tim Davidson Don James
Port Edwards	Roland Kahlstrom
Port Washington	Larry Tutewohl
Schofield	Burleigh Riggle
Sheboygan	Robert Kulhanek
Sheboygan Falls	John Brown Frederick Lampe
Slinger	Nancy Schilling

District	Representative
South Wayne	Robert Beaver John Tenges
Strum	Mark Ryser
Union Grove	Judy Maas
Watertown	Donovan Richards
Waupun	Sue Blomgren Armin Paff
Wautoma	Frank Pico
Whitewater	Wally Peterson Jack Trojan

State Superintendent's Policy on Competency Based Education

The State Superintendent of Public Instruction views competency based education programs and assessment as alternatives available to local school districts to improve the attainment of desired outcomes from the instructional programs. The State Superintendent appointed a Blue Ribbon Commission, on the thirteen standards and competency based education, to examine the implications for the Department of Public Instruction and local school districts in implementing competency based programs in Wisconsin. The State Superintendent has adopted the following policy and positions in respect to competency based education upon consideration of the Commission's recommendations:

1. Competency based education should be a local school district initiative and responsibility.

2. The State Department of Public Instruction should provide, commensurate with personnel and resources available, technical assistance in this area to school districts. The state pupil assessment program will establish a bank of competency based education objectives and measurement items which local school districts may consider for use in their programs as resources permit.

3. The State Superintendent recommends that each school district which implements a competency based education program should establish a developmental model which contains the following elements or characteristics:

    a) Involves local community citizens.

    b) Provides training to professional staff.

    c) Establishes both minimum and optimum student competency levels.

    d) Provides remedial training for students who fail to attain desired competencies.

    e) Notifies the public of competency based education goals and objectives prior to implementation of the program.

    f) Provides for periodic evaluation of student competencies during the K-12 school years.

    g) Provides for continuing evaluation of program competencies to allow for planned modification.

4. All decisions in respect to requirements for promotion and graduation shall be the responsibility of each individual school district.

The Department of Public Instruction recommends that since S.118.015 requires local school districts to develop and implement a comprehensive K-12 reading program, this area may be considered as an initial area for competency based education programming. Reading is among the basic skills in which public concern is expressed and which are essential to future success in school.

The State Legislature's Position on Competency Based Education

Richard Flintrop, Chairman of the Assembly Education Committee was interviewed regarding the legislature's position. The questions and his answers were:

1) Is any legislation related to competency based education being considered by your committee?
   Answer: NO.
2) Do you expect any such legislation to be introduced in the forseeable future?
   Answer: NO.
3) Would the Education Committee be likely to approve such a bill if it were introduced?
   Answer: NO.
4) Is the Governor's Office advocating legislation mandating competency testing?
   Answer: NO.

A STATEMENT ON COMPETENCY TESTING FROM
REMARKS BY ACTING GOVERNOR MARTIN J. SCHREIBER
WISCONSIN ASSOCIATION OF SCHOOL BOARDS
MARC PLAZA, MILWAUKEE, WISCONSIN
FRIDAY, JANUARY 20, 1978

Local control will also be emphasized in my annual review message in the area of competency testing. Although the state must retain the final responsibility for assessment of local educational programs, the responsibility for developing proficiency standards and competency testing should lie with local districts.

In this way, information can be collected at the state level to indicate trends in student abilities, while local school districts can continue to determine their own needs.

THE WISCONSIN PUPIL ASSESSMENT PROGRAM

LOCAL EDUCATION AGENCY PIGGY-BACK PROJECT (LEAPP)

The Local Education Agency Piggy-back Project (LEAPP) was initiated in response to requests for local school district results on the state pupil assessment instruments. In 1976 a pilot project was conducted in five school districts, and in 1977 a total of 39 school districts participated.

The assessment instruments are Wisconsin developed, objective-referenced tests in mathematics. They are written for fourth, eighth and twelfth grades and measure important objectives from the topics listed below.

OVERVIEW OF TOPICS INCLUDED IN THE FALL 1977 MATHEMATICS ASSESSMENT

COMPUTATION

ADDITION
- whole numbers with and without regrouping
- fractions with like/unlike denominators
- mixed numerals
- decimals (terminating)

SUBTRACTION
- whole numbers with and without regrouping
- fractions with like/unlike denominators
- mixed numerals with/without regrouping
- decimals (terminating)

MULTIPLICATON
- whole numbers with/without regrouping
- fractions
- decimals (terminating)

DIVISION
- whole numbers
- fractions
- decimals (terminating)

PROPORTION & PERCENT
- solve a simple proportion
- compute what percent one whole number is of another
- compute a given percent of a whole number

APPLICATIONS

MONEY APPLICATIONS
- determine the value of currency/coins
- find change from a purchase
- find total possible purchase
- find total cost
- find tax, tip or discount
- find cost after discount or surcharge
- find or compare unit price(s)
- find difference in wages or savings (expressed in different units)
- find travel cost
- find time, rate or earnings
- find earnings over time
- find pay after deductions, raise or overtime
- balance a checkbook
- budget living costs

MEASUREMENT APPLICATIONS
- find total area, length, weight, volume or time
- find starting, ending or elapsed time
- use a recipe
- find average size, units or mph
- compare temperatures, length, area, weight or volume
- read a ruler or odometer
- read maps, charts, graphs
- use a bus schedule

The cost to a district for participation in LEAPP for 1978 was approximately $ .55 per pupil. The participating district is then provided with copies of the Mathematics Assessment test for all fourth, eighth and twelfth grade students.

After testing, the district receives three reports: school results by domain, district and state item analysis, and school district and state item analysis. The district can also receive an individual pupil report for each student tested.

To participate in LEAPP or to obtain further information, contact James H. Gold, Director, Pupil Assessment Program, 126 Langdon Street - 227B, Madison, WI 53702 OR call 608-266-7941 OR 608-266-3126.

SUMMARY

CONFERENCE ON COMPETENCY BASED MATHEMATICS EDUCATION

Please evaluate the quality of the program in each of the following areas:

	not helpful				very helpful
1. Presentations of specific programs (Racine, Shawano, Manitowoc)	1	2 (3)	3 (4)	4 (37)	5 (22)
2. Presentations of general background (Chambers, Kepner)	1	2 (1)	3 (12)	4 (38)	5 (15)
3. Discussion groups	1 (2)	2 (6)	3 (17)	4 (22)	5 (14)
4. Printed material	1 (1)	2	3 (11)	4 (26)	5 (15)

5. Should a similar conference be held next year? yes (54) no (6)

6. If YES on "5", what particular issues would you like to have addressed?

7. If YES on "5", should the format be primarily presentation, primarily discussion, or a balance between the two?

MATHEMATICS OBJECTIVES - SAMPLE LISTS

Beckmann, Milton W. and Jack L. Beal. "Beckmann-Beal Mathematical Competencies Test for Enlightened Citizens." Lincoln, NE: Beckmann-Beal Testing Service, 3425 L Street. 1973.

Bell, Max. S. "What Does 'Everyman' Really Need from School Mathematics?" The Mathematics Teacher. March, 1974. pp. 196-202.

Burrill, Gail. "What Math Should All Twelfth Graders Know?" (included in this report)

The Committee on Basic Mathematical Competencies and Skills. "Mathematical Competencies and Skills Essential for Enlightened Citizens." The Mathematics Teacher. November, 1972. pp. 671-677.

Flanagan, John C., Robert F. Mager and William Shanner. Behavioral Objectives: A Guide to Individualizing Learning - Mathematics. Palo Alto, CA: Westinghouse Learning Press. 1971.

Michigan Department of Education. Minimal Performance Objectives for Mathematics Education in Michigan. East Lansing: The Department. 1973.

National Assessment of Educational Progress: Mathematics Objectives. Denver: Education Commission of the States. 1970.

National Council of Supervisors of Mathematics. NCSM Position Paper on Basic Mathematical Skills. (c/o: Ross Taylor, Minneapolis Public Schools, 807 Broadway NE, Minneapolis, MN 55413)

Wisconsin Department of Public Instruction. Wisconsin Statewide Assessment - Mathematics: An Exemplary Mathematics Program Grades K Through 8 AND A Hierarchy of Student Behavioral Objectives K-8. 1972.

Wisconsin Mathematics Assessment Committee. Interpretive Report on Wisconsin State Mathematics Assessment. Volume 1, Report 2. Madison: Wisconsin Department of Public Instruction, 1974.

CONTACT INDIVIDUALS - MATHEMATICS & MINIMAL COMPETENCIES

Jerry Cavanaugh, Supervisor
Development & Evaluation
Denver Public Schools
Denver, Colorado

Ron McCauly
Phoenix Union High School System
2526 W. Osborne Road
Phoenix, Arizona 85017

Glyn Sharpe
Mathematics Department
Jefferson County Schools
1209 Quail Street
Lakewood, Colorado 80215

Mr. Earl Tharp
Mathematics Supervisor
Columbus City Schools
270 E. State Street
Columbus, Ohio 43215

Steve Wallin
Mathematics Specialist
Charlotte-Mecklenburg Schools
P.O. Box 149
Charlotte, North Carolina 28230

Robert C. Clary
ESEA Title IV-C Director
Roanoke Rapids Grade School District
536 Hamilton Street
Roanoke Rapids, North Carolina 27870

What Math Should All Twelfth Graders Know?

by Gail Burrill

MORE AND MORE OFTEN THE REFRAIN of "why can't these kids do simple arithmetic?" is heard from shopkeepers, parents and employers. A small drugstore owner who gives a simple arithmetic test as a prerequisite for hiring a cashier had many high school seniors apply and none qualify. A physical education teacher complained because her students couldn't do the computation necessary for a bowling unit. A technical school found it necessary to require remedial mathematics for those students enrolling in apprentice programs.

Are arithmetic skills decreasing? Were they ever what they should have been? It is difficult to make many supported generalizations directly pertaining to the state of Wisconsin; few schools have administered tests to seniors consistently over a period of years, and studies can be found substantiating almost any point of view. The Scholastic Aptitude Test (SAT) scores show a decline in mathematics over the last ten years[1], but these tests are usually administered to only a small set of college bound students. It does seem, however, that the public is not satisfied with the mathematical competencies displayed by our high school graduates.

[1] *Guide for High Schools and Colleges, 1974, 1975*, College Entrance Examination Board.

Mrs. Burrill is chairman of the mathematics department at Whitnall High School Hales Corners.

With so much concern for education, with so much money invested in our schools, why should so many people be incompetent in the use of even simple mathematical skills? Why can't our graduates balance their checkbooks, add a sales slip or make correct change? One of the most probable reasons is inherent in the fact that in the majority of Wisconsin high schools only one year of mathematics is required for a diploma, and that one year is usually taken in grade nine. This means that many students graduate without having had a course in mathematics for three years, and even then, the course was often more theoretical than functional in a practical everyday sense. "Modern math" has become a national scapegoat and might be blamed in these cases by its critics for too much theory and not enough drill. It is true also that few schools have courses which make mathematics relevant to everyday concerns, although many provide an excellent background for college calculus.

Whatever the rationale, our elementary and secondary schools have been accused, at least indirectly, of not creating mathematical literates. Educators should not shrug off these claims, for they deal with the immediate practicality and utilization of information they teach, or should be teaching. Mathematics departments must take the responsibility of restructuring their curricula to emphasize not only the traditional algebra-geometry sequence, but also the role of mathematical processes and thinking in the world around them. They must take steps to insure that students will be capable of applying the mathematics they have learned.

How can these demands be met? How can a school be reasonably sure that a graduate will possess these skills, particularly without imposing a redundant course on those who already qualify in this respect? One answer could be found in a mathematics competency test given to all potential graduates, with failure used as a foundation for diagnosis and remedial work. This approach would necessitate that the test be administered near the end of the eleventh grade, early enough for registration for the succeeding year. For those who fail, there could be two options: a semester remedial course for the first half of twelfth grade or a self preparation program originated by the student. Near the end of the first term in grade 12 another form of the test could be readministered to those who had not yet passed. A student failing at this point would be programmed into a second semester course which would have as its basic objective the mastery of the skills necessary for passing the test. Those who did not pass after their third attempt would not be prevented from graduating, but their diploma would indicate a deficiency in mathematics.

A competency test would necessarily have to be based on a set of objectives developed within each district. The task of compiling these objectives could be enormous, but several sources of information are available. The Wisconsin Mathematics Assessment Program, in developing a test for twelfth graders, has formulated a list of objectives divided into three areas:

(1) Ninety-seven essential mathematical competencies,
(2) One hundred seventeen examples of applications of these competencies in the areas of measurment, comparison, money, costs, percent, ratio and proportion, probability and statistics, charts, tables, graphs, scale drawings, reasoning, and recreation, and
(3) A list of applications involving specialized knowledge outside of mathematics

The Wisconsin Mathematics Assessment Committee, composed of educators at various levels and from all parts of the state, used most of the material available to obtain its final list, and this list could provide excellent guidelines for a local district.

After modifying and adapting these objectives, each district could then construct a test based on its final conclusions. Because the test would have to be administered several times, equivalent forms would have to be set up, with care taken to insure that the difficulty level of comparable problems was preserved from test to test. (If, in a field test, three out of four were correct on a given problem, it should be replaced by one with the same achievement level.) If the test is to have content validity, there must be careful correlation between the stated objective and the test question; too often the statement says one thing, the test asks for another.

The question of norming a local test would have to be resolved in the construction process. An arbitrary success level for the entire test could be established at the discretion of the local department. Another feasible approach and perhaps more helpful for diagnostic purposes would be to indicate success objective by objective, with an arbitrary overall success level. This could be achieved by asking a given number of questions per objective with success criteria established to help compensate for pure randomness; for example, four questions on a given objective and three out of four correct would indicate the student has mastered that objective satisfactorily. Again, these standards are arbitrary and dependent on individual judgement but would give a consistent picture of the entire testing population.

The complete testing process, setting up the objectives, constructing the test and several forms, setting up norms, administering the test and interpreting the results would provide a long term in-service program for the local mathematics department. The result could have a dynamic and cohesive impact on the entire mathematics program. Not only would the process force an analysis of what, where and why their mathematics instruction is going, it should insure that twelfth graders know all the mathematics they need to know in order to function as effective and competent citizens.

Two lists of objectives developed by the Wisconsin Mathematics Assessment Committee are included here. The first is a list of mathematical competencies and the second a list of real-life applications of these competencies. Members of the committee are also listed.

Essential Mathematical Competencies

Students should be able to:

Number Concepts

1. Count the objects in a given set by 1's, 2's, 5's and 10's.
2. Given any counting number write the next counting number.
3. Read and write positive rational numbers (through billions) when represented by digits or words.
4. Given any two positive rational numbers, determine which is greater (or less) than the other.
5. Identify odd and even counting numbers.
6. Indicate an understanding of the concept of "percent."
7. Rename a given often-used positive rational number using decimal notation.
8. Rename a given often-used positive rational number using fraction notation (including mixed numbers).
9. Rename a given often-used positive rational number using percent notation.
10. Use a ratio to describe a given physical, pictorial or verbal situation.
11. Interpret a fraction as a part of a whole.
12. Interpret a fraction as parts of a group.
13. Indicate an understanding of the concept of negative numbers.
14. Express a number squared (exponent 2) as a product and conversely.
15. Express a number cubed (exponent 3) as a product and conversely.

Computation

16. Add whole numbers.
17. Subtract whole numbers.
18. Multiply whole numbers.
19. Divide whole numbers where the divisor has one or two digits, expressing the quotient in either fractional or decimal form.
20. Add fractions (including mixed numbers) having commonly used denominators.
21. Subtract fractions having commonly used denominators.
22. Multiply fractions having commonly used denominators.
23. Divide fractions where one number is a whole number.
24. Add decimals.
25. Subtract decimals.
26. Multiply decimals.
27. Divide decimals where the divisor is a whole number with one or two digits.
28. Compute the value of an expression containing more than one operation where parentheses indicate the order of operations.
29. Write equivalent fractions of the most often-used common fractions (including mixed numbers).
30. Given two whole numbers, compute what percent one is of the other.
31. Compute a given percent of a whole number.
32. Compute a given percent of a number having two places after the decimal point.
33. Given two decimals having two places after the decimal point, compute what percent one is of the other.
34. Round numbers to the nearest thousand, hundred, ten, one, tenth or hundredth.
35. Estimate results of computations.

Geometry

36. Recognize a triangle.
37. Recognize a rectangle.
38. Recognize a square.
39. Recognize a circle.
40. Recognize a sphere.
41. Recognize a cylinder.
42. Recognize a cone.

43. Recognize a cube.
44. Recognize a line segment.
45. Given a polygon, recognize a diagonal.
46. Given a circle, recognize a diameter.
47. Given a circle, recognize a radius.
48. Recognize an angle.
49. Recognize a right angle.
50. Recognize parallel lines.
51. Recognize intersecting lines.
52. Recognize perpendicular lines.
53. Recognize vertical directions.
54. Recognize horizontal directions.
55. Recognize an approximation of pi.
56. Given the lengths of the sides, compute the perimeter of a polygon.
57. Given the lengths of the sides, compute the area of a rectangle or square.
58. Given the lengths of the edges, compute the volume of a rectangular solid.
59. Indicate an understanding of the concept of area.
60. Indicate an understanding of the concept of volume.
61. Identify similar (same shape) geometric figures.
62. Identify congruent (same size and shape) geometric figures.
63. Recognize line symmetry in two dimensions.
64. Recognize plane symmetry in three dimensions.

Sentences

65. Given a simple formula and given the value of all but one variable of the formula, determine the value of the unknown variable.

Wisconsin Mathematics Assessment Committee

John Aceto, mathematics coordinator, Racine Public Schools.
Oswald Barth, high school mathematics teacher, Cuba City Public Schools.
Gail Burrill, mathematics department chairman, Whitnall High School, Hales Corners.
George L. Henderson, mathematics consultant, DPI, chairman.
Courtney Leonard, mathematics teacher and coordinator 7-12, Manitowoc Public Schools.
Vincent O'Connor, mathematics coordinator, Milwaukee Public Schools.
Jean Porter, principal, Deerwood Elementary School, Brown Deer Public Schools.
James Romig, assessment consultant, DPI.
Jane Schmeichel, elementary teacher, Two Rivers Public Schools.
Lucille Setz, elementary teacher, Monona Grove Public Schools.
DeLloyd Stertz, mathematics department, University of Wisconsin - Eau Claire.
John Tucker, mathematics teacher and acting principal, East Junior High School, Superior Public Schools.
Mary Van Beck, mathematics teacher, Nicolet High School, Glendale.
Sister Josephine Weiler, mathematics department chairman, Newman High School, Wausau.
Harry Wolff, mathematics department, University of Wisconsin-Oshkosh.
Sheila Zaharik, junior high school mathematics teacher, Eau Claire Public Schools.

66. Recall the simple interest formula.
67. Solve simple-interest equations.
68. Recall the basic distance-rate formula.
69. Solve basic distance-rate equations.
70. "Set up" a simple proportion.
71. Solve a simple proportion.

Measurement

72. Compute intra-system conversions of English linear measure.
73. Compute intra-system conversions of English weight.
74. Compute intra-system conversions of English capacity.
75. Compute intra-system conversions of metric linear measure.
76. Compute intra-system conversions of metric weight/mass.
77. Compute intra-system conversions of metric capacity.
78. Round off measurement to the nearest given unit of a measuring device.

Graphing

79. Recognize incorrectly organized data.
80. Recognize incorrectly constructed tables.
81. Recognize incorrectly constructed charts.
82. Recognize incorrectly constructed graphs.
83. Interpret information from bar graphs.
84. Interpret information from circle graphs.
85. Interpret information from picto-graphs.
86. Interpret information from line graphs.
87. Interpret information from tables.
88. Interpret information from charts.

Statistics and Probability

89. Express the probability of an event as the ratio of the number of successes to the total number of possible outcomes.
90. Given two or more whole numbers and/or decimals to two places, determine the mean (average) of the numbers.
91. Recognize the ambiguity of "average," including the difference between the **concepts** of mean and median.
92. Recognize valid and invalid inferences drawn from data.

Reasoning

93. Judge the reasonableness of answers.
94. Recognize that one counterexample is sufficient to deny the validity of a generalization.
95. Given x where x implies y, recognize that y follows logically.
96. Given y where x implies y, recognize that x need not follow logically.
97. Use inductive reasoning to arrive at conjectures.

Applications (Examples)

Students should be able to:

Measurement — Length

1. Use standard measuring devices to measure length.
2. Convert a specified linear measure from one unit to another intrasystem. (English or metric)
3. Convert a specified linear measure from one unit to another intersytem. (English to/from metric)
4. Convert a specified linear measure from one unit to another intrasystem using a conversion table. (English or metric)
5. Convert a specified linear measure from one unit to another intersystem using a conversion table. (English to/from metric)

6. Solve application problems involving measures of length.
7. Solve application problems involving travel.
8. Given a distance in miles and the time it took to travel that distance, calculate the average rate of speed in miles per hour.
9. Given the time it took to travel a distance and the average rate of speed in miles per hour, calculate the distance traveled.
10. Given a distance to be covered, the average speed of a mode of transportation, and a time of departure, estimate the time of arrival.
11. Given the number of miles driven and the total number of gallons of gasoline used, calculate the miles per gallon.

Measurement — Weight/Mass

12. Use standard measuring devices to measure weight/mass.
13. Convert a specified weight/mass from one unit to another intrasystem. (English or metric)
14. Convert a specified weight/mass from one unit to another intersystem. (English to/from metric)
15. Convert a specified weight/mass from one unit to another intrasystem using a conversion table. (English or metric)
16. Convert a specified weight/mass from one unit to another intersystem. (English to/from metric)
17. Solve application problems involving measures of weight/mass.

Measurement — Capacity/Volume

18. Use standard measuring devices to measure capacity.
19. Convert a specified capacity from one unit to another intrasystem. (English or metric)
20. Convert a specified capacity from one unit to another intersystem. (English to/from metric)
21. Convert a specified capacity from one unit to another intrasystem using a conversion table. (English or metric)
22. Convert a specified capacity from one unit to another intersystem using a conversion table. (English to/from metric)
23. Solve application problems involving measures of capacity/volume.
24. Given the dimensions of a space to be filled with concrete, calculate the number of cubic yards of concrete needed to fill that space.

Measurement — Area

25. Solve application problems involving measures of area.
26. Given the floor dimensions in feet of a room, calculate the number of square feet in the room.
27. Given the dimensions in feet of a particular room or set of rooms, calculate the number of square yards of carpeting or tile required to cover the floor(s).
28. Given the area that can be covered by one can of paint and the dimensions of a room in need of repainting, calculate the number of cans of paint required to repaint the room.

28a. Convert a specified number of square feet (square yards) to square yards (square feet).

29. Given the dimensions of one sheet of paneling and the dimensions of a given room, calculate the minimum number of sheets of paneling needed to cover the walls of the room.

Measurement — Temperature

30. Use standard measuring devices to measure temperature.
31. Convert a specified temperature from one unit to another using a conversion table. (Fahrenheit to/from Centigrade)
32. Solve application problems involving measures of temperature.

Measurement — Time

33. Use standard measuring devices to measure time.
34. Solve application problems involving measures of time.
35. Given the beginning time and the ending time of a particular time period (hours and minutes) calculate the elapsed time.
36. Given time zones and knowing time in one time zone, give the time in another time zone.
37. Given the time of departure on a trip, a time zone map, and the estimated travel time, determine the local time of arrival at the destination.

Comparisons

38. Compare linear measures expressed in the same system. (English or metric)
39. Compare those linear measures that don't need conversions expressed in different systems. (English and metric)
40. Compare measures of weight-mass expressed in the same system. (English or metric)
41. Compare those measures of weight/mass that don't need conversions expressed in different systems. (English and metric)
42. Compare measures of capacity expressed in the same system. (English or metric)

42a. Compare a specified number of square feet and square yards.

43. Compare those measures of capacity that don't need conversions expressed in different systems. (English and metric)
44. Given the lengths of two similar objects, one expressed as a fraction and the other as a decimal, determine which object is longer.
45. Compare two rates, one expressed as a fraction and one as a percent. (e.g. 40% off versus ½ off)
46. Given the dimensions for a set of socket wrenches (scrambled), arrange them in ascending order of size.
47. Given a list of people and their heights (or weights), list the people in order of descending height (or weight).
48. Given the dimensions and area formulas of two different regions, determine which region has the greater area.
49. Given the dimensions and the volume formulas of two different containers, determine which container has the greater capacity.
50. Given the single issue price of a monthly magazine and the yearly subscription rate, determine the amount of savings realized through a yearly subscription.
51. Given two products of the same quality, but of different size and price, determine which product is the better buy by calculating and comparing their unit prices.
52. Given the cost to play nine holes of golf, the probable number of times a person might play during the season, and the cost of a season pass, determine whether the purchase of a season pass is more economical than paying the single round fee.
53. Determine whether the purchase of a season pass (or season ticket) is more economical than paying the single entrance price for state parks, national parks, theater, athletic club, etc.

Money

54. Given bills and coins of different denominations, determine the amount of money.
55. Change money from one denomination to another.
56. Given two or more amounts of money, find the total amount of money.
57. Given two or more amounts of money, subtract a smaller amount from a larger amount.
58. Multiply an amount of money by a whole number.
59. Multiply an amount of money by a positive rational number.
60. Divide an amount of money by a whole number.
61. Divide an amount of money by a positive rational number.

Costs

62. Given the amount of money tendered and the cost of a purchase, calculate the amount of change the customer should receive back.
63. Given a series of purchases, add up the purchases to find the total cost.
64. Given the cost per mile to operate an automobile, calculate the cost of driving a particular distance.
65. Given the yearly cost of particular household maintenance and upkeep items, calculate the average monthly cost.
66. Calculate the unit cost of an item measured by capacity/volume.
67. Calculate the unit cost of an item measured by weight/mass.
68. Given the rate for purchasing travelers' checks, calculate the cost of purchasing a particular amount of travelers checks.
69. Given an hourly babysitting rate and the parent's departure and return time, calculate the babysitting cost for an evening out.

70. Given an hourly wage rate and the number of hours worked, calculate a paycheck (before deductions).
71. Given a weekly salary and the number of weeks worked, calculate a paycheck.
72. Solve application problems about shopping.
73. Solve application problems about wages.

Percent

74. Determine a given percent of a given amount of money.
75. Given two amounts of money, determine what percent one is of the other.
76. Given the check for a meal at a restaurant and a fixed percent of tipping, calculate the amount of the tip.
77. Given the cost of a purchase and the percent of sales tax, calculate the amount of sales tax and the total cost.
78. If the purchase price of an item is reduced (increased) by a given percent, calculate the amount of reduction (increase) and the new purchase price.
79. If the purchase price of an item is reduced a given amount, calculate the percent of discount.
80. If there are two ways to purchase an item, a) total price at the time of purchase and b) installment payments according to a time payment plan, calculate the cost (if any) of using the time payment plan.
81. Calculate the annual interest rate given principle, monthly payment, and the number of payments.
82. Given the amount of a savings account deposit, the percent of interest, and length of deposit time, calculate the simple interest and/or the total amount on deposit.
83. Given the mill rate (explain mill) and the assessed valuation of a piece of property, compute the property tax.
84. Solve application problems about taxes.
85. Solve application problems about interest.
86. Solve application problems about discount.

Ratio and Proportion

87. Describe a given physical situation using a ratio.
88. Given the average amount of meat consumed by one person at a dinner party, calculate the amount of meat needed to serve the entire dinner party.
89. Given the weight of a cut of meat to be cooked and the length of time to cook one pound of that meat, determine the approximate cooking time for the given cut of meat.
90. Given a recipe designed to feed a certain number of people, increase (decrease) the recipe proportionately in order to feed more (less) people.

Probability and Statistics

91. State probabilities of events in fractional form.
92. Given that x out of y people do or think something, determine how many would do or think that same thing out of z people.
93. Given that x% of a group of people does or thinks something, determine how many would do or think that same thing out of z people.
94. Recognize the difference in computing the mean (average) income and the median income.

Charts, Tables, Graphs

95. Given an airline/bus/train timetable, determine the time of departure, time of arrival and traveling time.
96. Given a sales tax table and the price of a purchase, determine the amount of sales tax.
97. Given a gasoline tax table and a total number of miles traveled in a given year, determine the amount of tax.
98. Given an income tax table and a net taxable hypothetical income, determine the amount of income tax due.
99. Interpret a graph showing where a governmental unit gets its revenue.
100. Interpret a circle graph showing how the total tax dollar is distributed between local, state, and federal.

101. Interpret a circle graph showing at each level of government how the total tax dollar is distributed.
102. Interpret a graph, table, or chart showing how one's personal income is spent.
103. Interpret a graph of the stock market over a period of time.
104. Given a list of stock market figures from the daily newspaper, list the prices of given stocks and their increases or decreases from the previous day's figures.
105. Given automobile accident statistics over a period of four years, identify increases or decreases.
106. Given a lender's table, determine the monthly payment on a given loan over a given period of time at a specified rate of interest.
107. Given a grid-system city map and a particular street (landmark), locate the given street (landmark) and answer questions about it.
108. Given a road map containing a table of distances between cities, determine the distance between two given cities, using the table.

Scale Drawings

109. Interpret scale drawings.
110. Determine measures of real objects from scale drawings.
111. Make a scale drawing of a floor plan from given specifications.
112. Given a map with an inch-to-mile distance scale, use the scale to answer questions about distances on the map.
113. Given a road map with mileage listed between cities, determine the distance from one city to another when he must go through at least two other cities to reach his destination.

Reasoning

114. Detect and describe flaws and fallacies in advertising and propaganda where statistical data and inferences are employed.
115. Given that overnight parking is on the side of the street with even house numbers on even numbered days and on the side with odd house numbers on odd numbered days, determine which side of the street to park on a given day.

Recreation

116. Solve application problems about recreation.
117. Given a basketball box score with field goals, free throws, and personal fouls and the information that field goals are 2 points, free throws are 1 point, and 5 personal fouls disqualifies a player from additional play, answer questions about the box score.

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Department of Public Instruction, Division for Instructional Services - 12-13-76

NICOLET HIGH SCHOOL

JOINT UNION HIGH SCHOOL DISTRICT No. 1

8701 NORTH JEAN NICOLET ROAD GLENDALE, WISCONSIN 53217 TELEPHONE (414) 352-7110

September 15, 1977

Dear Parent:

The Nicolet High School Mathematics Department believes that it is very important for all students to maintain and show proficiency in elementary arithmetic skills and applications prior to graduation. Therefore, the department has developed a three-phase arithmetic skills and applications program. The three phases of the program are:

* skills maintenance
* testing
* remediation and retesting

The aim of the program is to specify what is basic proficiency, to identify students who do or do not perform to a minimum standard, and to provide remediation for those who need extra help.

The math department has determined that students should be able to demonstrate proficiency in the following areas of elementary arithmetic skills and applications:

* number concepts
* estimation and approximation
* computational skills
* arithmetic applications
* geometry and measurement
* graphs, tables and charts
* probability and statistics

In October, all members of the class of 1979 will be administered a proficiency test covering the areas mentioned above. Included with this letter you will find the 48 performance objectives developed by the department. Following each objective is a sample test item intended to measure the preceeding objective. Your son/daughter should use this guide in preparation for the competency test. You, as a parent, may enjoy testing your own performance in respect to the stated objectives.

Students not showing proficiency in the objectives tested will be required to participate in a program of remediation and be tested each semester until proficiency is shown. You and your son/daughter will be informed of the specific areas of weakness in such cases.

Whether or not proficiency has been met on these skills and applications will be noted on your son/daughter's transcript at the time of graduation.

Questions regarding this minimum competency program should be directed to me at 352-7110, ext. 67.

Sincerely yours,

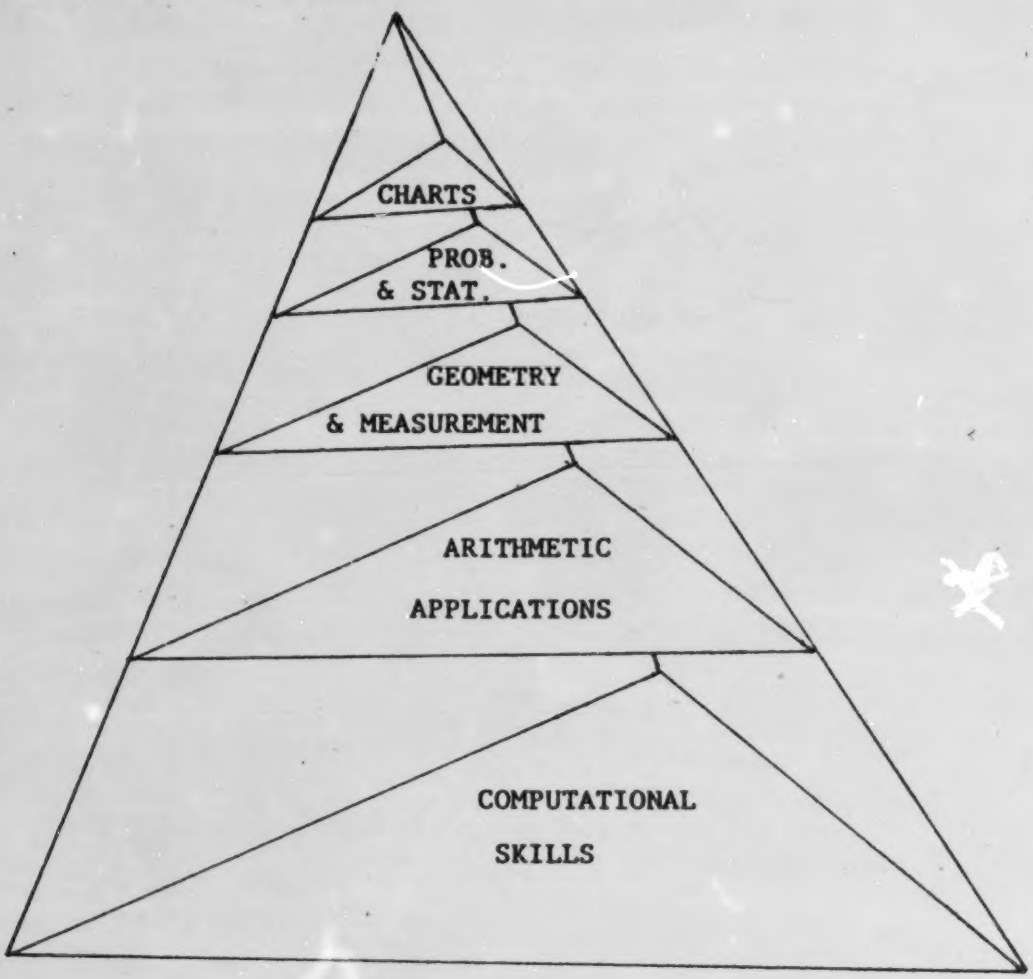
NICOLET HIGH SCHOOL

D. R. Johnson

David R. Johnson
Chairman Mathematics Department

DRJ/lb
Encl.

OBJECTIVES FOR ARITHMETIC SKILLS AND APPLICATIONS PROGRAM



MATHEMATICS DEPARTMENT

Nicolet High School

PREFACE

The Mathematics Department of Nicolet High School presents the objectives stated in this document as necessary to demonstrate proficiency in elementary arithmetic skills and applications. The major areas are: number concepts; estimation and approximation; computational skills; arithmetic applications; geometry and measurement; graphs, tables, and charts; probability and statistics.

These are presented in the belief that there is a need to maintain elementary arithmetic skills and applications for all students through-out high school.

To enable students to demonstrate their proficiency in these elementary arithmetic skills and applications, the Mathematics Department will test all junior students in October, 1977. Individual results will be shared with the parents of each student.

Questions and inquiries can be directed to the Mathematics Department Chairman, Mr. David R. Johnson at 352-7110, Ext. 67.

NUMBER CONCEPTS

The students should be able to:

1. Read numerals in words or digits.

   Write as a numeral: thirty thousand, forty — Ans. 30,040

2. Interpret numerals using powers of ten.

   $10^3 \times 10^2$ represents which numeral? — Ans. 100,000

3. Demonstrate an understanding of positive and negative numbers.

   On Saturday the high temperature was 5^oC. On Sunday it was -6^oC. What was the difference in temperature? — Ans. 11^o

4. Count numbers and order numbers.

   Fill in the correct number to complete the pattern.

   36, 40, 44, _____, 52, 56 — Ans. 48

ESTIMATION AND APPROXIMATION

The students should be able to:

5. Round numbers to a given place.

   Round 354.786 to the nearest tenth — Ans. 354.8

6. Estimate results of computations.

   39 x 51 would be greater than or less than 1000? — Ans. greater than (because 40 x 50 = 2000)

7. Estimate the length of a common object in metric units.

   The length of this page is about _____ cm. — Ans. 20-35 (the actual length is 28 cm)

COMPUTATIONAL SKILLS

The students should be able to:

8. add whole numbers.

   $137 + 56 + 2691$ Ans. 2884

9. Subtract whole numbers. Ans. 846

$$\begin{array}{r} 1500 \\ -\ 654 \\ \hline \end{array}$$

10. Multiply whole numbers.

    107×64 Ans. 6848

11. Divide whole numbers.

    $3684 \div 12$ Ans. 307

12. Add fractions.

    Write answer as a reduced fraction.

    $\frac{3}{4} + \frac{5}{8}$ Ans. $\frac{11}{8}$ or $1\frac{3}{8}$

    $2\frac{1}{3} + 1\frac{1}{2}$ Ans. $\frac{23}{6}$ or $3\frac{5}{6}$

13. Subtract fractions.

    Write answer as a reduced fraction.

    $\frac{3}{4} - \frac{2}{3}$ Ans. $\frac{1}{12}$

    $6\frac{1}{2} - 4\frac{5}{8}$ Ans. $\frac{15}{8}$ or $1\frac{7}{8}$

14. Multiply fractions.

    Write answer as a reduced fraction.

    $\frac{1}{3} \times \frac{5}{8}$ Ans. $\frac{5}{24}$

15. Divide fractions.

Write answer as a reduced fraction.

$\frac{1}{2} \div 5$ Ans. $\frac{1}{10}$

$15 \div 2\frac{1}{2}$ Ans. 6

16. Add decimals.

$6 + .47 + 8.2 + .009$ Ans. 14.679

17. Subtract decimals.

$25.3 - 2.53$ Ans. 22.77

18. Multiply decimals.

$$\begin{array}{r} .52 \\ \times\ .3 \\ \hline \end{array}$$ Ans. .156

19. Divide a decimal by a whole number.

$9\overline{).36}$ Ans. .04

20. Given a fraction or decimal, write as a percent.

Write as a percent: .4 Ans. 40%

$\frac{7}{20}$ Ans. 35%

21. Given a decimal or percent, write as a fraction.

Write as a reduced fraction: .85 Ans. $\frac{85}{100} = \frac{17}{20}$

70% Ans. $\frac{7}{10}$

22. Given a percent or fraction, write as a decimal.

Write as a decimal: $\frac{1}{4}$ Ans. .25

$5\frac{3}{4}\%$ Ans. .0575

23. Write an improper fraction as a mixed number.

$\frac{27}{5}$ Ans. $5\frac{2}{5}$

24. Given two whole numbers, compute what percent one is of the other.

    72 is what percent of 60? Ans. 120%

25. Compute a given percent of a whole number.

    Find the value to the nearest hundredth:
    What is 15% of 85? Ans. 12.75

26. Solve a proportion.

    Find n: $\frac{15}{n} = \frac{25}{5}$ Ans. 3

27. Solve simple and parenthetical number sentences.

    Find n: $n = 8 \times (2 + 3)$ Ans. 40

    $n - 8 = 15$ Ans. 23

ARITHMETIC APPLICATIONS

The students should be able to:

28. Demonstrate the ability to describe problems in mathematical terms.

    If a dozen apples cost $2.40, what operation (+, −, x, ÷) would you use to find out how much each apple costs? Ans. ÷

29. Make decisions involving pertinent information in solving problems.

    Susan earned $6.25 babysitting. What information would you need to know to find her rate of pay per hour?

    a. How old she was.
    b. The time she began babysitting.
    c. The number of hours she babysat.
    d. How many children she babysat for. Ans. C

30. Solve consumer problems involving money.

    Allison spent $15.49. She gave the clerk a twenty dollar bill. How much change did she receive? Ans. $4.51

A record album regularly cost $5.98. On sale they are 3 for $17. How much money would you save if you bought the three records on sale? Ans. $.94

Steve earns $4.00 per hour for the first 40 hours that he works and time and a half for every hour over 40. If he worked 46 hours last week, how much did he earn? Ans. $196

31. Solve consumer problems involving rates.

The Schmatzhagen family traveled at an average speed of 50 mph. on their trip. If they traveled for 7 hours 30 minutes how far did they go? Ans. 375 miles

Sue bought a radio. The price tag read $13.50 plus tax. How much tax must she pay at a rate of 4%? Ans. 54¢

A sign reads: soda, 8 bottles for $1.20. At this rate how much will 10 bottles cost? Ans. $1.50

32. Solve consumer problems involving length, weight (mass), area, and volume (capacity).

Before a trip the car's odometer was 56,285.7. At the end of the trip it was 60,147.3. How long was the trip? Ans. 3861.6

How many $1\frac{1}{2}$ foot pieces of ribbon can be cut from 4 yards of ribbon? Ans. 8

If a gallon of paint covers 400 square feet, how many gallons of paint would Joe need to paint both sides of a fence 6 feet high and 150 feet long? Ans. $4\frac{1}{2}$ gallons

33. Solve consumer problems involving time and temperatures.

Tom can save $50 a month. How many months will it take him to save enough for a $680 stereo? Ans. 14 months or 1 yr, 2 months

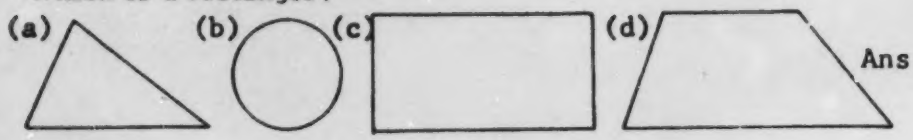
You land at Washington National Airport at 6:45 p.m. and your connecting flight leaves at 8:30 p.m. How much time do you have between planes? 1 hour 45 minutes

GEOMETRY AND MEASUREMENT

The students should be able to:

34. Identify a triangle, square, rectangle, and circle.

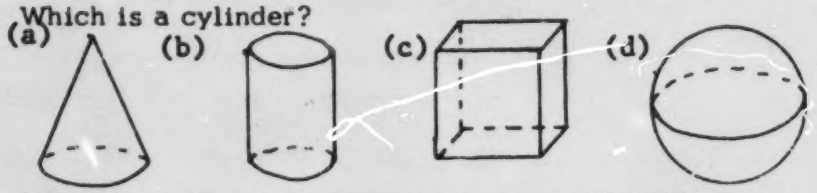
Which is a rectangle?



Ans. C

35. Identify a cone, pyramid, cylinder, sphere, and cube.

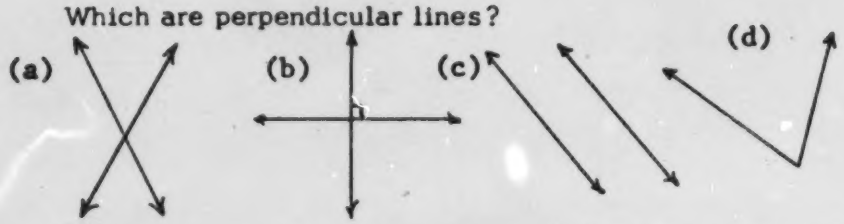
Which is a cylinder?



Ans. B

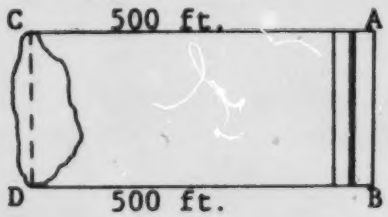
36. Identify angles, intersecting lines, parallel lines, and perpendicular lines.

Which are perpendicular lines?



Ans. B

37. Use properties of squares, rectangles, and parallelograms to solve problems.

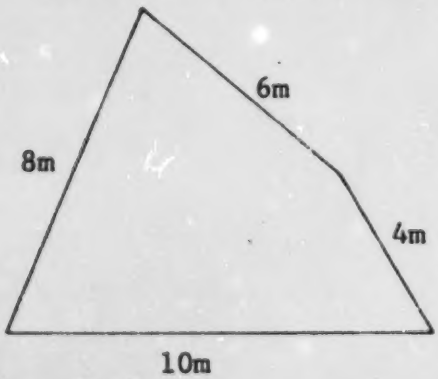


A road runs parallel to a 3 mile long lake. How far is it from A to B?

Ans. 3 miles

38. Find the perimeter of a polygon.

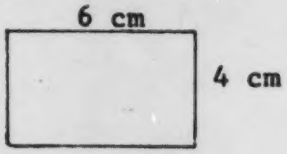
Find the perimeter of the figure.



Ans. 28m

39. Find the area of a rectangle and a square.

Find the area of the rectangle.



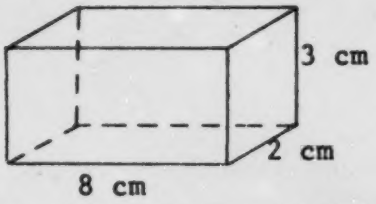
Ans. 24 cm^2

40. Find the area of a circle given the formula and an approximation for

Find the area of a circle with radius 10 cm. Use $A = \pi r^2$ and $\pi = 3.14$. Ans. 314cm^2

41. Find the volume of a rectangular solid.

Find the volume of the rectangular solid.



Ans. 48cm^3

42. Name the metric unit appropriate for measuring a common commodity.

Which metric unit would best be used to measure the length of your living room. (i.e. millimeter, meter, gram, liter) Ans. meter

43. Con vert one metric unit of measure to another.

Change 2.4 kilograms to grams. Ans. 2400 grams

44. Given a conversion table, convert measures of length, weight (mass), and capacity (volume).

Use the conversion table to find the number of kilometers in 15 miles. Ans. 24 kilometers

English	Metric
1 mile	1.6 km
0.62 miles	1 km

GRAPHS, TABLES, AND CHARTS

The students should be able to:

45. Read and interpret information from tables, charts, and maps.

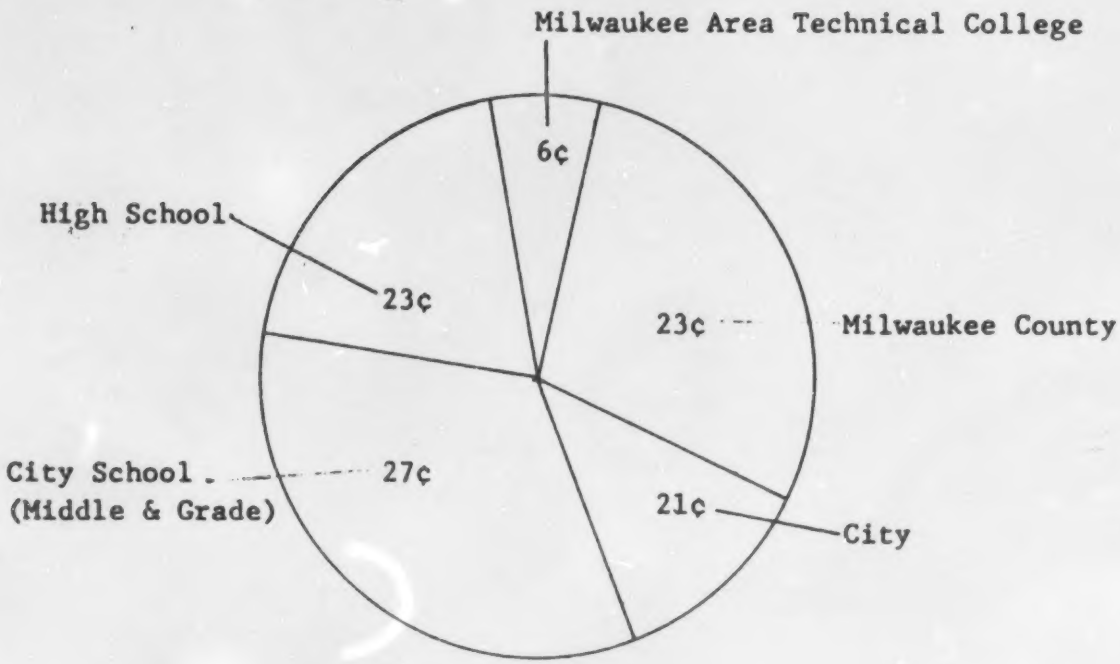
CITY TIMETABLE

MADISON

	Leave	Arrive	Flight No.	Stops	Freq.
To Chicago	7:25 a	8:00 a	414	NON-STOP	Ex Su
	11:35 a	12:14 p	434	NON-STOP	Daily
	3:00 p	3:39 p	736	NON-STOP	Daily
	6:50 p	7:34 p	470	NON-STOP	Daily
From Chicago	7:55 a	8:35 a	423	NON-STOP	Daily
	10:55 a	11:37 a	435	NON-STOP	Ex Su
	1:25 p	2:06 p	439	NON-STOP	Ex Sa
	2:40 p	3:18 p	535	NON-STOP	Daily

Which flight (number) would you use if you were ready to leave Madison for Chicago anytime after 4:00 p.m.? Ans. 470

46. Read and interpret information from bar, circle, picto- and line graphs.



If you paid $1000 in taxes for 1977, how much of your taxes went to the middle and grade school?

Ans. $270

PROBABILITY AND STATISTICS

The students should be able to:

47. Use the probability of an event as the ratio of the number of successes to the total number of possible outcomes.

A ball is chosen from random from an urn containing 2 white balls, 3 black balls, and 4 red balls. What is the probability that a red ball will be chosen? Ans. $\frac{4}{9}$

48. Find the mean (average) of a given set of numbers.

Find the mean (average) rainfall for the summer if the record showed: Ans. 2.08

June:	3.47 in.
July:	2.43 in.
August:	0.34 in.

Objectives require familiarity with this vocabulary:

addition

area

average (mean)

between

circle

compute

cone

cube

counting number
(natural number)

cylinder

decimal

decrease

difference

digit

division

English units of measure
(foot, pound, gallon, etc.)

equilateral triangle

factor

fraction

increase

intersecting (lines)

isosceles triangle

least common denominator

length

mean (average)

metric units of measure
(meter, liter, gram, etc.)

multiplication

number

number sentence

numeral

of

parallel (lines)

parallelogram

percent

perimeter

perpendicular (lines)

probability (of an event)

product

pyramid

quotient

rate

rectangle

rectangular solid

remainder

rounded

sphere

square

subtraction

sum

total

triangle

volume

NICOLET HIGH SCHOOL

JOINT UNION HIGH SCHOOL DISTRICT No 1

8701 NORTH JEAN NICOLET ROAD GLENDALE, WISCONSIN 53217 TELEPHONE (414) 352-7110

January 1978

In October the mathematics department administered an arithmetic skills and applications test to all members of the junior class. This test was based on the arithmetic skills and applications objectives in the following areas:

- number concepts
- estimation and approximation
- computational skills
- arithmetic applications
- geometry and measurement
- graphs, tables and charts
- probability and statistics

The mathematics department considers achievement above 80% on this test as minimum proficiency in arithmetic skills and applications.

We are pleased to inform you that your son/daughter has met this proficiency level for arithmetic skills and applications. This fact will be noted on his/her transcript. You may wish to make copies of this letter for future job applications. Specific scores can be obtained by calling the math department office.

Sincerely yours,

Dennis M. Fischer

Dennis Fischer
Chairman, Competency Committee
Mathematics Department

D. R. Johnson

David R. Johnson
Chairman
Mathematics Department

NICOLET HIGH SCHOOL

6701 NORTH JEAN NICOLET ROAD GLENDALE, WISCONSIN 53217 TELEPHONE (414) 352-7110

January, 1978

In October the mathematics department administered an arithmetic skills and applications test to all members of the junior class. This test was based on the arithmetic skills and applications objectives sent to you in September. The areas tested included:

- number concepts
- estimation and approximation
- computational skills
- arithmetic applications
- geometry and measurement
- graphs, tables and charts
- probability and statistics

The mathematics department considers achievement above 80% on this test as demonstrating minimum proficiency in arithmetic skills and applications. Your son/daughter did not meet this competency level. The specific areas of weakness noted are checked below:

_____ whole numbers and decimal place value
_____ rational numbers and numeration
_____ operations and properties
_____ subtraction of whole numbers
_____ multiplication of whole numbers
_____ division of whole numbers
_____ operations with fractions
_____ operations with decimals
_____ operations with percent
_____ number sentences
_____ problem solving
_____ reading and interpreting tables and graphs
_____ geometry and measurement

Your son/daughter may see his/her score and number correct in each area by stopping in the mathematics office (B-24). This information is also available to you by calling the mathematics office.

In May, 1978 your son/daughter will be required to re-take this competency test. From now until May he/she should review and practice problems in each area of weakness noted above. In addition, if your son/daughter is enrolled in a math class, a skills maintenance worksheet will be distributed every week. (If not enrolled in a math class, worksheets can be obtained weekly in B-24). Mathematics resource teachers are located in F-5 throughout the day. Encourage your son/daughter to come to F-5 during study periods to practice problems in each area of weakness. We also encourage you to help your son/daughter, using the enclosed objectives and sample questions as guidelines.

The results of this May test will also be reported to you. Failing to pass the competency test in May will mean that your son/daughter will be requested to participate in a remediation program during the senior year.

If proficiency is met, it will be noted on the transcript at the time of graduation. Questions regarding this minimum competency program should be directed to the mathematics department.

Sincerely yours,

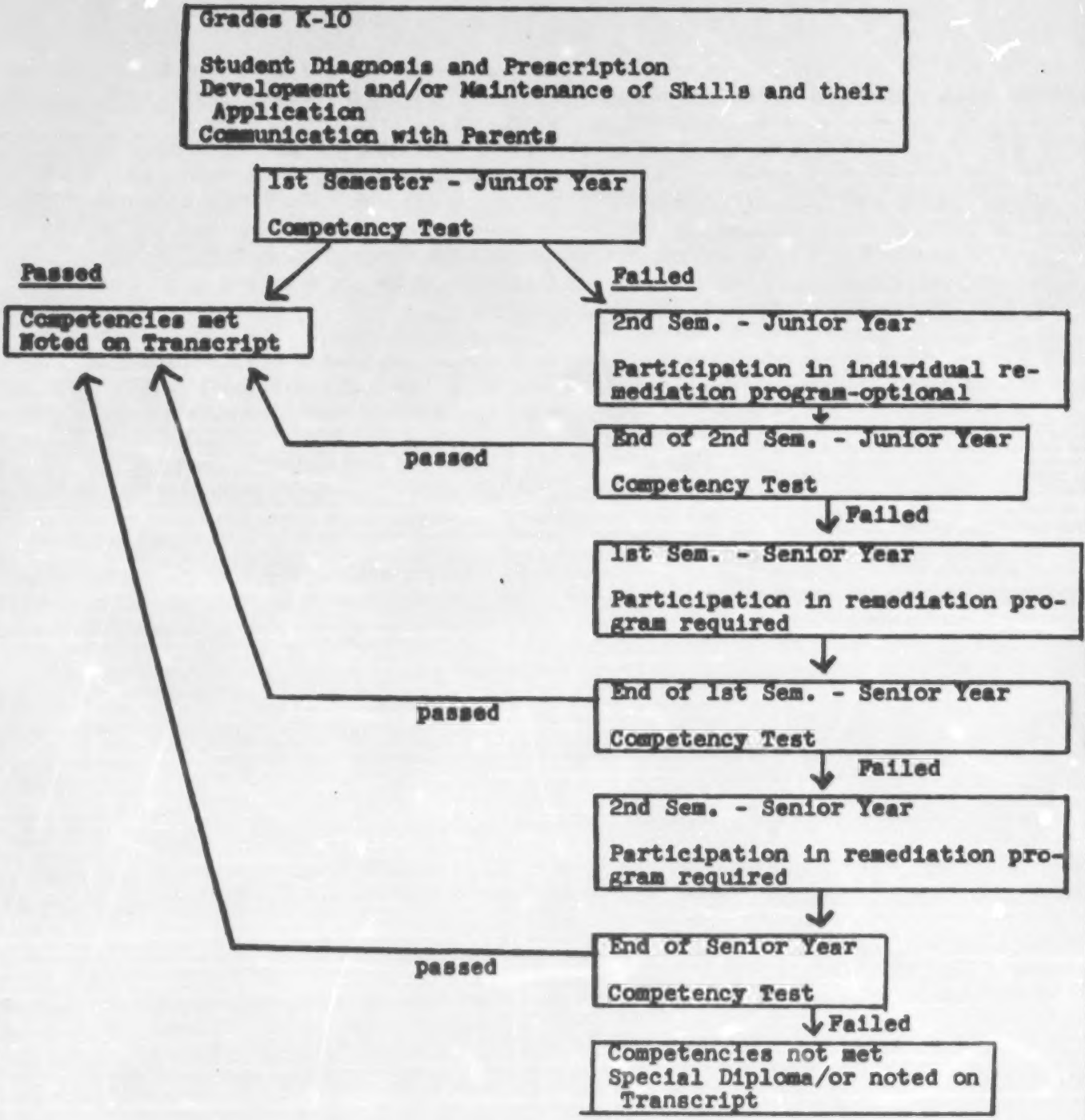
Dennis M. Fischer

Dennis Fischer
Chairman Competency Committee
Mathematics Department

D. R. Johnson

David R. Johnson
Chairman
Mathematics Department

COMPETENCY MAINTENANCE PROGRAM



SUGGESTED READINGS
COMPETENCY BASED EDUCATION

Clark, James P. and Thomson, Scott D., Competency Tests and Graduation Requirements. Reston, VA (22091): The National Association of Secondary School Principals, 1976

The Phi Delta Kappan, Vol. 58, No. 7, March, 1977.

A special issue with several articles addressing "Back-to-Basics" and competencies. Examples: "Nostalgia's Child: Back to the Basics", "Back to Basics: The Movement and Its Meaning", "American Education: Its Failure and Its Future", "The Greensville Program: A Common Sense Approach to Basics", "How School Control Was Wrested from the People". (Phi Delta Kappan, Eighth and Union, Box 789, Bloomington, IN 47401)

NATIONAL COUNCIL OF SUPERVISORS OF MATHEMATICS POSITION PAPER ON BASIC MATHEMATICAL SKILLS

INTRODUCTION

The currently popular slogan "Back to the Basics" has become a rallying cry of many who perceive a need for certain changes in education. The result is a trend that has gained considerable momentum and has initiated demands for programs and evaluations which emphasize narrowly defined skills.

Mathematics educators find themselves under considerable pressure from boards of education, legislatures, and citizens' groups who are demanding instructional programs which will guarantee acquisition of computational skills. Leaders in mathematics education have expressed a need for clarifying what are the basic skills needed by students who hope to participate successfully in adult society.

The narrow definition of basic skills which equates mathematical competence with computational ability has evolved as a result of several forces:

1. Declining scores on standardized achievement tests and college entrance examinations;
2. Reactions to the results of the National Assessment of Educational Progress;
3. Rising costs of education and increasing demands for accountability;
4. Shifting emphasis in mathematics education from curriculum content to instructional methods and alternatives;
5. Increased awareness of the need to provide remedial and compensatory programs;
6. The widespread publicity given to each of the above by the media.

This widespread publicity, in particular, has generated a call for action from governmental agencies, educational organizations, and community groups. In responding to these calls, the National Institute of Education adopted the area of basic skills as a major priority. This resulted in a Conference on Basic Mathematical Skills and Learning, held in Euclid, Ohio, in October, 1975.

The National Council of Supervisors of Mathematics (NCSM), during the 1976 Annual Meeting in Atlanta, Georgia, met in a special session to discuss the Euclid Conference Report. More than 100 members participating in that session expressed the need for a unified position on basic mathematical skills which would enable them to provide more effective leadership within their respective school systems, to give adequate rationale and direction in their tasks of implementing basic mathematics programs, and to appropriately expand the definition of basic skills. Hence, by an overwhelming majority, they mandated the NCSM to establish a task force to formulate a position on basic mathematical skills. This statement is the result of that effort.

RATIONALE FOR THE EXPANDED DEFINITION

There are many reasons why basic skills must include more than computation. The present technological society requires daily use of such skills as estimating, problem solving, interpreting data, organizing data, measuring, predicting, and applying mathematics to everyday situations. The changing needs of society, the explosion of the amount of quantitative data, and the availability of computers and calculators demand a redefining of the priorities for basic mathematics skills. In recognition of the inadequacy of computation alone, NCSM is going on record as providing both a general list of basic mathematical skills and a clarification of the need for such an expanded definition of basic skills.

Any list of basic skills must include computation. However, the role of computational skills in mathematics must be seen in the light of the contributions they make to one's ability to use mathematics in everyday living. In isolation, computational skills contribute little to one's ability to participate in mainstream society. Combined effectively with the other skill areas, they provide the learner with the basic mathematical ability needed by adults.

DEFINING BASIC SKILLS

The NCSM views basic mathematical skills as falling under ten vital areas. The ten skill areas are interrelated and many overlap with each other and with other disciplines. All are basic to pupils' development of the ability to reason effectively in varied situations.

This expanded list is presented with the conviction that mathematics education must not emphasize computational skills to the neglect of other critical areas of mathematics. The ten components of basic mathematical skills are listed below, but the order of their listing should not be interpreted as indicating either a priority of importance or a sequence for teaching and learning.

Furthermore, as society changes our ideas about which skills are basic also change. For example, today our students should learn to measure in both the customary and metric systems, but in the future the significance of the customary system will be mostly historical. There will also be increasing emphasis on when and how to use hand-held calculators and other electronic devices in mathematics.

TEN BASIC SKILL AREAS

Problem Solving

Learning to solve problems is the principal reason for studying mathematics. Problem solving is the process of applying previously acquired knowledge to new and unfamiliar situations. Solving word problems in texts is one form of problem solving, but students also should be faced with non-textbook problems. Problem-solving strategies involve posing questions, analyzing situations, translating results, illustrating results, drawing diagrams, and using trial and error. In solving problems, students need to be able to apply the rules of logic necessary to arrive at valid conclusions. They must be able to determine which facts are relevant. They should be unfearful of arriving at tentative conclusions and they must be willing to subject these conclusions to scrutiny.

Applying Mathematics to Everyday Situations

The use of mathematics is interrelated with all computation activities. Students should be encouraged to take everyday situations, translate them into mathematical expressions, solve the mathematics, and interpret the results in light of the initial situation.

Alertness to the Reasonableness of Results

Due to arithmetic errors or other mistakes, results of mathematical work are sometimes wrong. Students should learn to inspect all results and to check for reasonableness in terms of the original problem. With the increase in the use of calculating devices in society, this skill is essential.

Estimation and Approximation

Students should be able to carry out rapid approximate calculations by first rounding off numbers. They should acquire some simple techniques for estimating quantity, length, distance, weight, etc. It is also necessary to decide when a particular result is precise enough for the purpose at hand.

Appropriate Computational Skills

Students should gain facility with addition, subtraction, multiplication, and division with whole numbers and decimals. Today it must be recognized that long, complicated computations will usually be done with a calculator. Knowledge of single-digit number facts is essential and mental arithmetic is a valuable skill. Moreover, there are everyday situations which demand recognition of, and simple computation with, common fractions.

Because consumers continually deal with many situations that involve percentage, the ability to recognize and use percents should be developed and maintained.

Geometry

Students should learn the geometric concepts they will need to function effectively in the 3-dimensional world. They should have knowledge of concepts such as point, line, plane, parallel, and perpendicular. They should know basic properties of simple geometric figures, particularly those properties which relate to measurement and problem-solving skills. They also must be able to recognize similarities and differences among objects.

Measurement

As a minimum skill, students should be able to measure distance, weight, time, capacity, and temperature. Measurement of angles and calculations of simple areas and volumes are also essential. Students should be able to perform measurement in both metric and customary systems using the appropriate tools.

Reading, Interpreting, and Constructing Tables, Charts, and Graphs

Students should know how to read and draw conclusions from simple tables, maps, charts, and graphs. They should be able to condense numerical information into more manageable or meaningful terms by setting up simple tables, charts, and graphs.

Using Mathematics to Predict

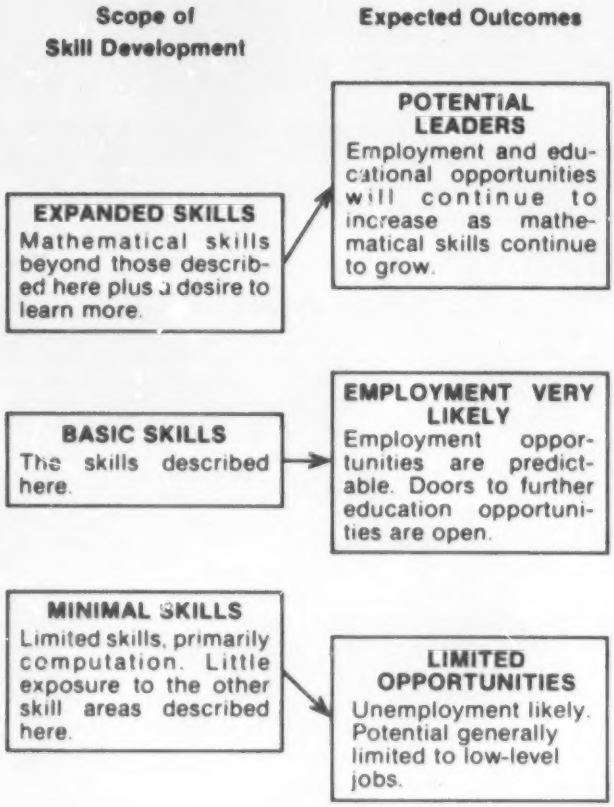
Students should learn how elementary notions of probability are used to determine the likelihood of future events. They should learn to identify situations where immediate past experience does not affect the likelihood of future events. They should become familiar with how mathematics is used to help make predictions such as election forecasts.

Computer Literacy

It is important for all citizens to understand what computers can and cannot do. Students should be aware of the many uses of computers in society, such as their use in teaching/learning, financial transactions, and information storage and retrieval. The "mystique" surrounding computers is disturbing and can put persons with no understanding of computers at a disadvantage. The increasing use of computers by government, industry, and business demands an awareness of computer uses and limitations.

BASIC SKILLS AND THE STUDENT'S FUTURE

Anyone adopting a definition of basic skills should consider the "door-opening/door-closing" implications of the list. The following diagram illustrates expected outcomes associated with various amounts of skill development.


Scope of Skill Development
Expected Outcomes
EXPANDED SKILLS
Mathematical skills beyond those described here plus a desire to learn more.
POTENTIAL LEADERS
Employment and educational opportunities will continue to increase as mathematical skills continue to grow.
BASIC SKILLS
The skills described here.
EMPLOYMENT VERY LIKELY
Employment opportunities are predictable. Doors to further education opportunities are open.
MINIMAL SKILLS
Limited skills, primarily computation. Little exposure to the other skill areas described here.
LIMITED OPPORTUNITIES
Unemployment likely. Potential generally limited to low-level jobs.

MINIMUM ESSENTIALS FOR HIGH-SCHOOL GRADUATION

Today some school boards and state legislatures are starting to mandate mastery of minimum essential skills in reading and mathematics as a requirement for high-school graduation. In the process, they should consider the potential pitfalls of doing this without an appropriate definition of "basic skills." If the mathematics requirements are set inordinately high, then a significant number of students may not be able to graduate. On the other hand, if the mathematics requirements are set too low and mathematical skills are too narrowly defined, the result could be a sterile mathematics program concentrating exclusively on learning of low-level mathematical skills. This position paper neither recommends nor condemns minimal competencies for high-school graduation. However, the ten components of basic skills stated here can serve as guidelines for state and local school systems that are considering the establishment of minimum essential graduation requirements.

DEVELOPING THE BASIC SKILLS

One individual difference among students is style or way of learning. In offering opportunities to learn the basic skills, options must be provided to meet these varying learning styles. The present "back-to-basics" movement may lead to an emphasis on drill and practice as a way to learn.

Certainly drill and practice is a viable option, but it is only one of many possible ways to bring about learning and to create interest and motivation in students. Learning centers, contracts, tutorial sessions, individual and small-group projects, games, simulations and community-based activities are some of the other options that can provide the opportunity to learn basic skills. Furthermore, to help students fully understand basic mathematical concepts, teachers should utilize the full range of activities and materials available, including objects the students can actually handle.

The learning of basic mathematical skills is a continuing process which extends through all of the years a student is in school. In particular, a tendency to emphasize computation while neglecting the other nine skill areas at the elementary level must be avoided.

EVALUATING AND REPORTING STUDENT PROGRESS

Any systematic attempt to develop basic skills must necessarily be concerned with evaluating and reporting pupil progress.

In evaluation, test results are used to judge the effectiveness of the instructional process and to make needed adjustments in the curriculum and instruction for the individual student. In general, both educators and the public have accepted and emphasized an overuse of and overconfidence in the results of standardized tests. Standardized tests yield comparisons between students and can provide a rank ordering of individuals, schools, or districts. However, standardized tests have several limitations including the following:

a. Items are not necessarily generated to measure a specific objective or instructional aim.
b. The tests measure only a sample of the content that makes up a program; certain outcomes are not measured at all.

Because they do not supply sufficient information about how much mathematics a student knows, standardized tests are not the best instruments available for reporting individual pupil growth. Other alternatives such as criterion tests or competency tests must be considered. In criterion tests, items are generated which measure the specific objectives of the program and which establish the student's level of mastery of these objectives. Competency tests are designed to determine if the individual has mastered the skills necessary for a certain purpose such as entry into the job market. There is also need for open-ended assessments such as observations, interviews, and manipulative tasks to assess skills which paper and pencil tests do not measure adequately.

Reports of pupil progress will surely be made. But, while standardized tests will probably continue to dominate the testing scene for several years, there is an urgent need to begin reporting pupil progress in other terms, such as criterion tests and competency

measures. This will also demand an immediate and extensive program of inservice education to instruct the general public on the meaning and interpretation of such data and to enable teachers to use testing as a vital part of the instructional process.

Large scale testing, whether involving all students or a random sample, can result in interpretations which have great influence on curriculum revisions and development. Test results can indicate, for example, that a particular mathematical topic is being taught at the wrong time in the student's development and that it might better be introduced later or earlier in the curriculum. Or, the results might indicate that students are confused about some topic as a result of inappropriate teaching procedures. In any case, test results should be carefully examined by educators with special skills in the area of curriculum development.

CONCLUSION

The present paper represents a preliminary attempt by the National Council of Supervisors of Mathematics to clarify and communicate its position on basic mathematical skills. The NCSM position establishes a framework within which decisions on program planning and implementation can be made. It also sets forth the underlying rationale for identifying and developing basic skills and for evaluating pupils' acquisition of these competencies. The NCSM position underscores the fundamental belief of the National Council of Supervisors of Mathematics that any effective program of basic mathematical skills must be directed not "back" but *forward* to the essential needs of adults in the present and future.

You are encouraged to make and distribute copies of this paper.

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NATIONAL COUNCIL OF SUPERVISORS OF MATHEMATICS
c/o Ross Taylor
Minneapolis Public Schools
807 Broadway N. E.
Minneapolis, Minnesota 55413

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MEMBERS OF NCSM TASK FORCE ON BASIC MATHEMATICAL SKILLS

Mildred Daniels	Detroit Public Schools, Detroit, MI
David Dye	Minnesota Department of Education, St. Paul, MN
Jane Donnelly Gawronski	San Diego County Department of Education, San Diego, CA
William J. Geppert[1]	Delaware Department of Public Instruction, Dover, DE
Peggy A. House	University of Minnesota, Minneapolis, MN
Elgin Schilhab	Austin Independent School District, Austin, TX
Glyn Sharpe	Jefferson County Public Schools, Lakewood, CO
Albert P. Schulte	Oakland Public Schools, Pontiac, MI
Dorothy Strong	Chicago Board of Education, Chicago, IL
B. Ross Taylor[2]	Minneapolis Public Schools, Minneapolis, MN
Alex Tobin[3]	School District of Philadelphia, Philadelphia, PA
Kay Tobin	Lexington Public Schools, Lexington, MA
Edward Esty[4]	National Institute of Education, Washington, D. C.

[1]President, Association of State Supervisors of Mathematics
[2]NCSM Basic Skills Task Force Chairperson
[3]President, NCSM
[4]Resource Person, National Institute of Education

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